TECHNOLOGY DEP

POWER

SEPTEMBER 1942

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRIES

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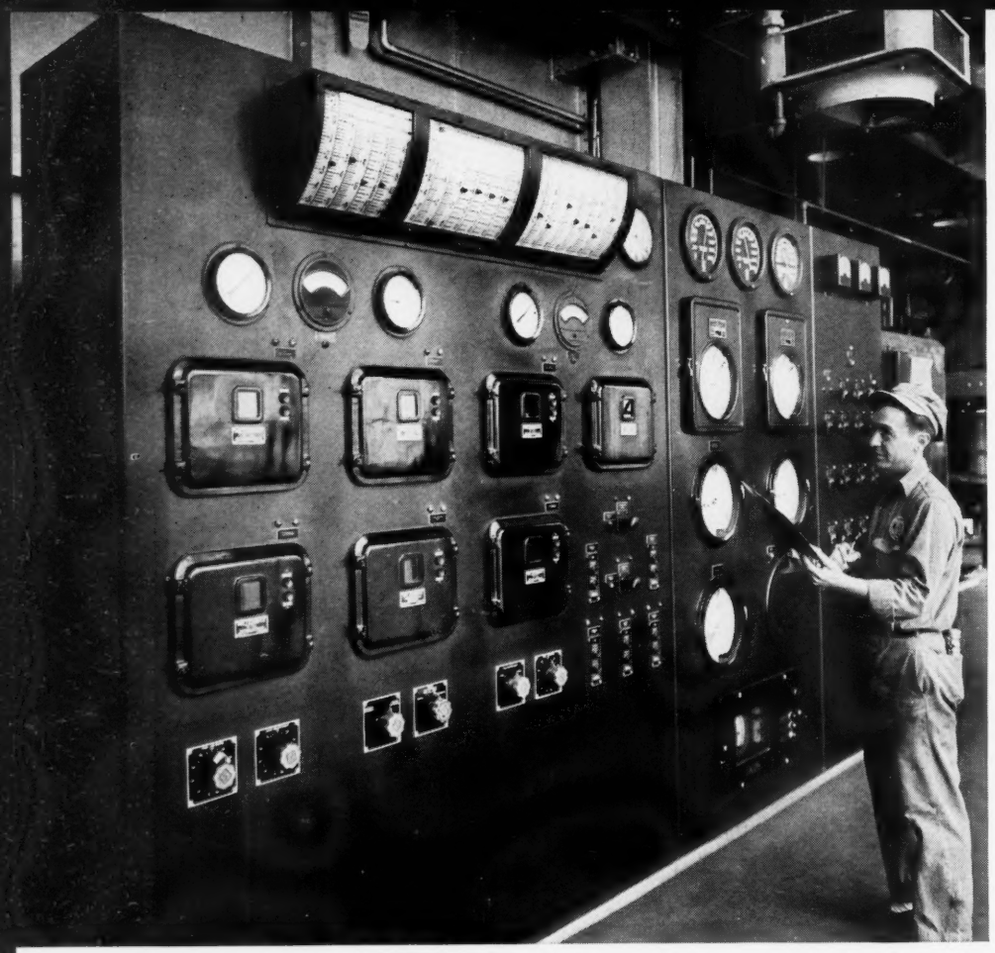
SEP 5 - 1942

POWER TEAMWORK FOR VICTORY



Situated in an Illinois industrial area, this central station's Metermax Combustion Controllers are helping meet the power needs of scores of war-rushed, emergency-handling plants. Note the convenience to the operator of having the Controllers, as well as switches, etc., directly on the instrument panel—this arrangement is standard—not special—with Metermax.

War-Load Emergencies? Metermax Meets Them!

Ability to head off trouble, in present-day power-plant operations, is one of Metermax Control's principal assets. Several dozen features of the Control apply, in one or another of the emergency situations which may arise; here, for example, are four which are especially useful if the power plant's air or electric services are interrupted:

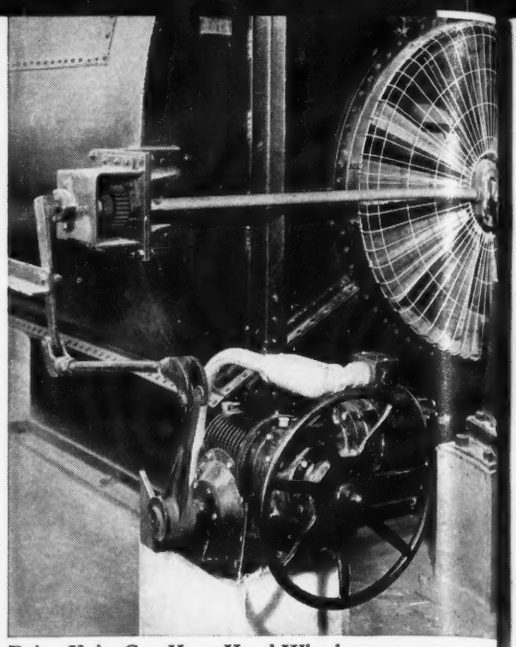
1. Should the air-supply fail, there's a 20-minute reserve (for 6 boilers) in a tank furnished as part of the Control. Metermax uses only about ½ cu. ft. of air per minute, and pressure is only 12 to 14 in. water.

2. If prolonged air-failure should exhaust the reserve supply, the dampers, etc., would automatically remain in existing positions, but could then be moved by push-button control, or by hand.

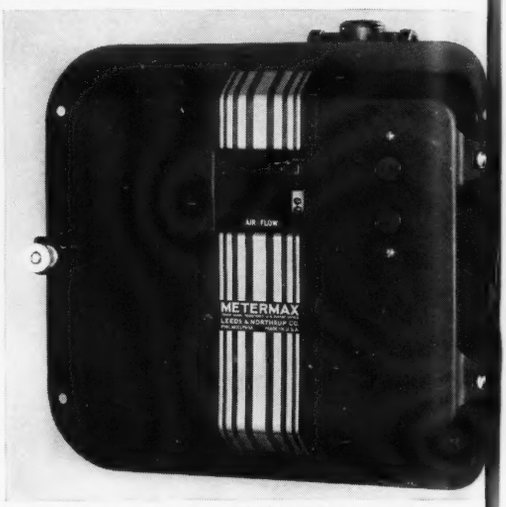
3. In case of failure of electric supply to the drive units, the dampers, etc., would remain in existing positions unless moved by hand. Dampers cannot back-drive a de-energized Metermax drive unit.

4. Operator can turn instantly from automatic to manual control, by simply throwing a switch. It is not necessary to balance pressures or lose time in any other way.

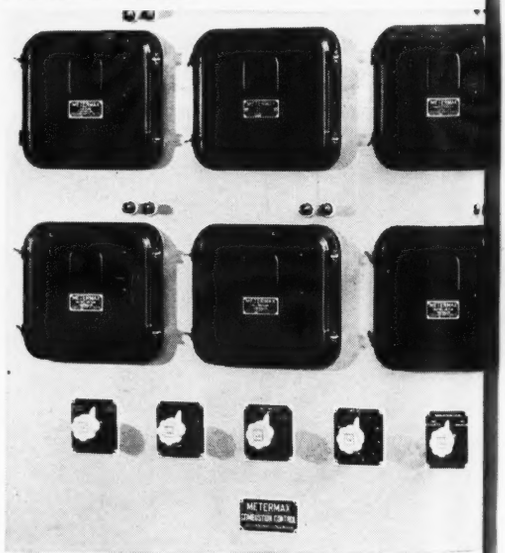
Metermax Combustion Control is described, with photographs and layout diagrams for various types of boilers, in our 32-page Catalog N-01-163, which will be sent on request. For more specific engineering information, just outline your problem.



Drive Units Can Have Hand Wheels



Controllers Can Be Provided With Integral Push Button Station.



The Switch Setting Determines Whether Control Is Automatic Or Manual. The Transfer Can Be Made Quickly Without Balancing Pressure.

Jrl Ad N-01-163(3)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

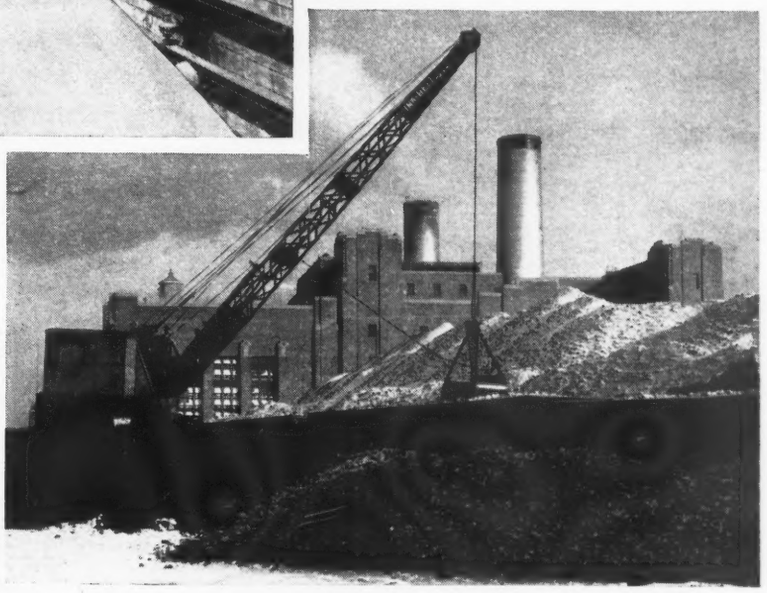
POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), September, 1942, Vol. 86, No. 9. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. EDITORIAL AND EXECUTIVE OFFICES, 330 WEST 42ND STREET, NEW YORK, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

PLAN for Adequate Coal Storage NOW

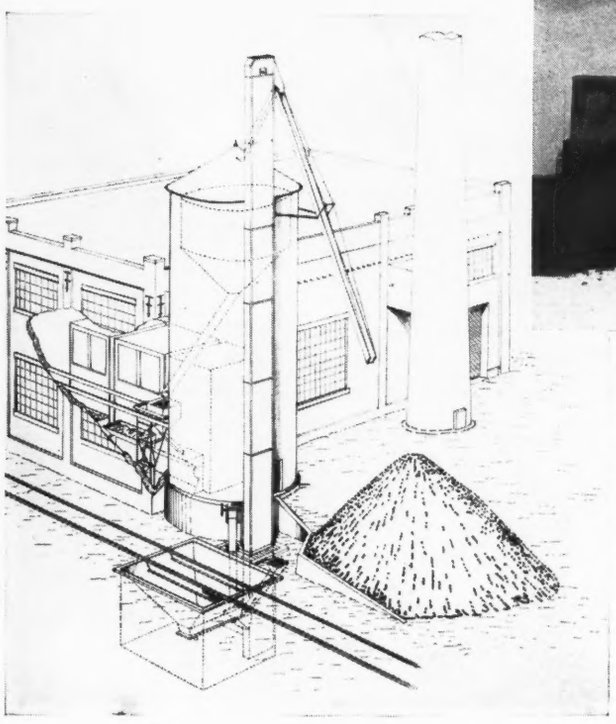
A complete Link-Belt system of handling coal from self-unloading lake vessels direct to plant or to storage piles or from storage to plant, as desired. Employs three standard Link-Belt Speed-o-Matic cranes, belt conveyors, traveling reclaiming hoppers, a traveling reciprocating feeder and a portable stacker-conveyor. Flexible, efficient, high capacity.

•

Link-Belt Speed-o-Matic crawler crane unloading coal from railroad cars to storage pile at power plant.



★ ★ ★



A simple, versatile, economical power plant coal storage method—the Link-Belt silo system. This system combines all handling functions in a simple, compact unit, suitable for either new or existing installations. Usually silos are located adjacent to the boiler house but constructed independently, and equipment within the boiler house consists entirely of means for distributing the coal. Frequently a single spout from the silo is all that is needed. Silos may be designed for normal storage requirements or equipped with auxiliary spout to provide additional outside reserve storage when desired. Link-Belt's broad experience in the art of storing and reclaiming coal is available to you.

LINK-BELT COMPANY, Chicago, Philadelphia, Indianapolis, Atlanta, Dallas, San Francisco, Toronto. Offices in principal cities. 8904

LINK-BELT

. . . Coal And Ashes Handling Equipment

CONVEYORS • ELEVATORS • SKIP HOISTS • CRUSHERS • LARRIES • SCREENS

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B&W INTEGRAL-FURNACE BOILER

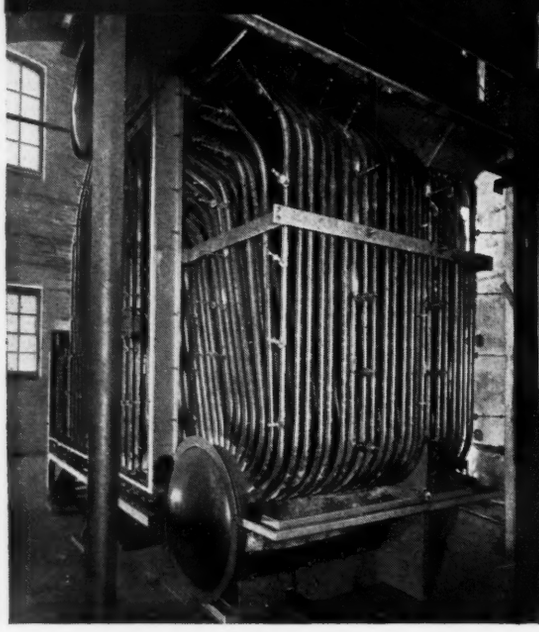
CLASSES 9, 12, AND 15

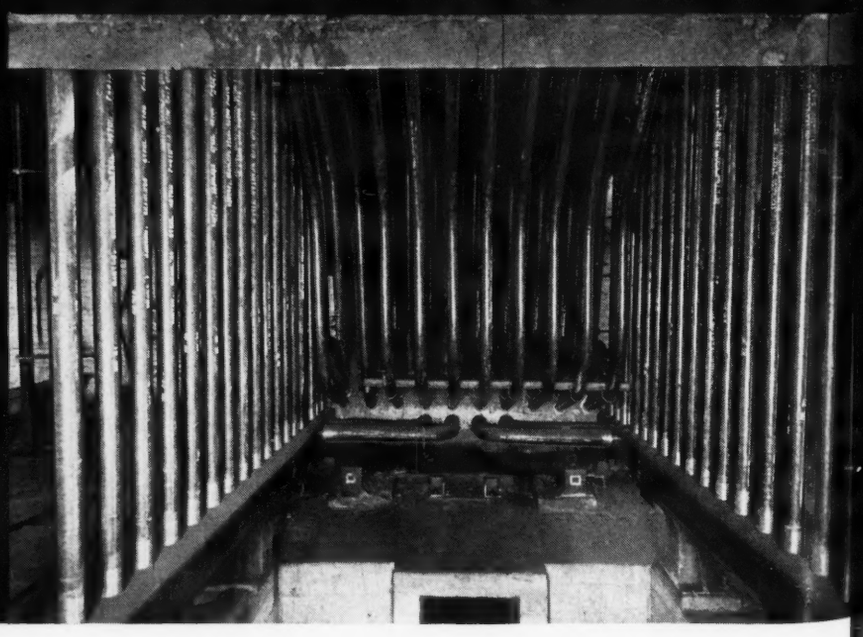
ADAPTABILITY INDICATED BY SALES RECORDS

The adaptability of the B&W Integral-Furnace Boiler in the smaller sizes — classes 9, 12, and 15 — is indicated by the table below, which shows the application of more than a hundred boilers on the basis of size and pressure. It is noteworthy that 72 per cent of these boilers are for stoker firing and the remainder are for oil firing.

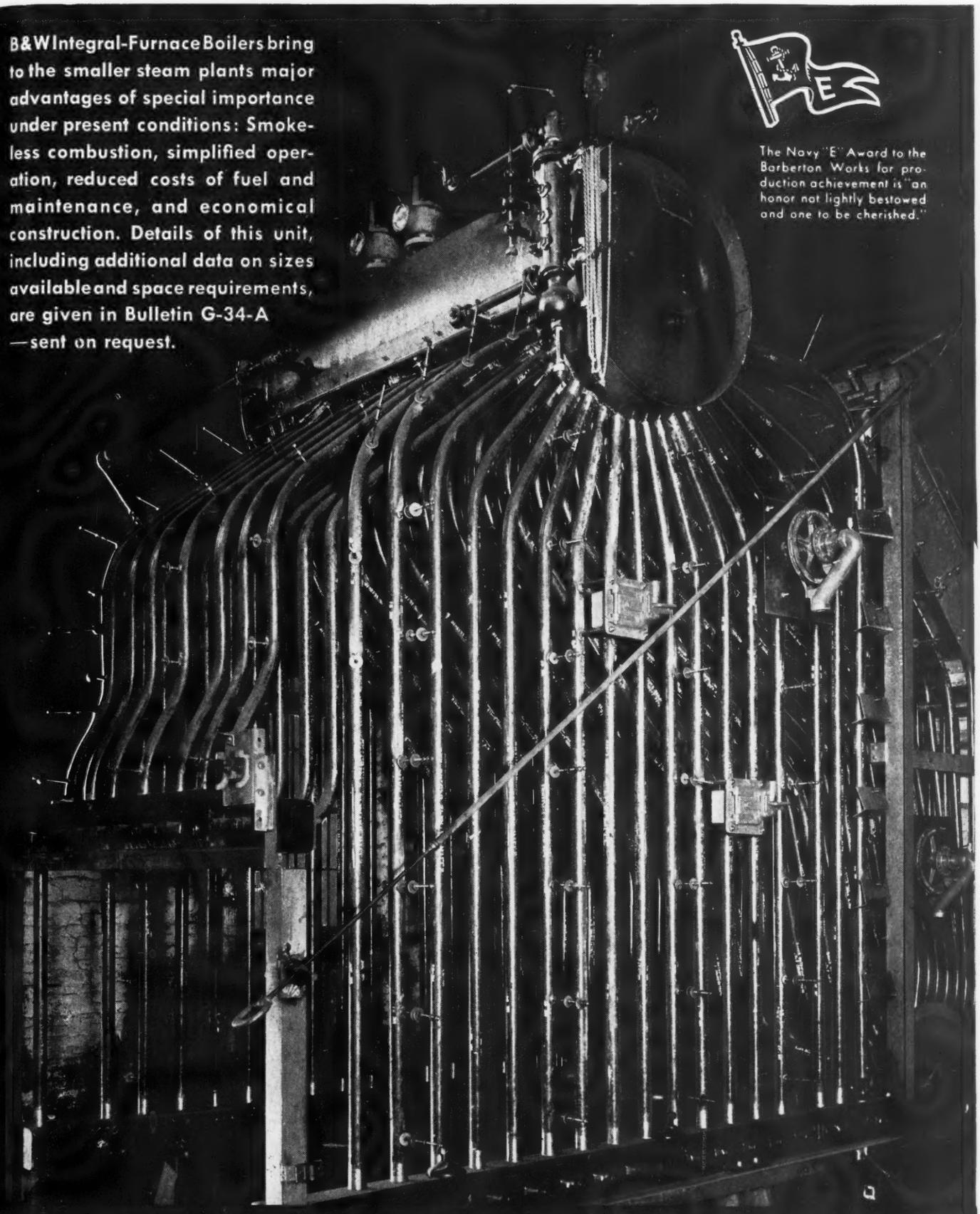
APPLICATION OF BOILERS			
By Boiler Horsepower		By Steam Pressure	
Boiler Horsepower Range	Per Cent of Steam Capacity	Steam Pressure Range, Psi	Per Cent of Steam Capacity
100–400	25.7	150–200	73.3
400–600	66.8	200–250	22.7
600–700	7.5	250 Up	4.0

G-230T





B&W Integral-Furnace Boilers bring to the smaller steam plants major advantages of special importance under present conditions: Smokeless combustion, simplified operation, reduced costs of fuel and maintenance, and economical construction. Details of this unit, including additional data on sizes available and space requirements, are given in Bulletin G-34-A —sent on request.

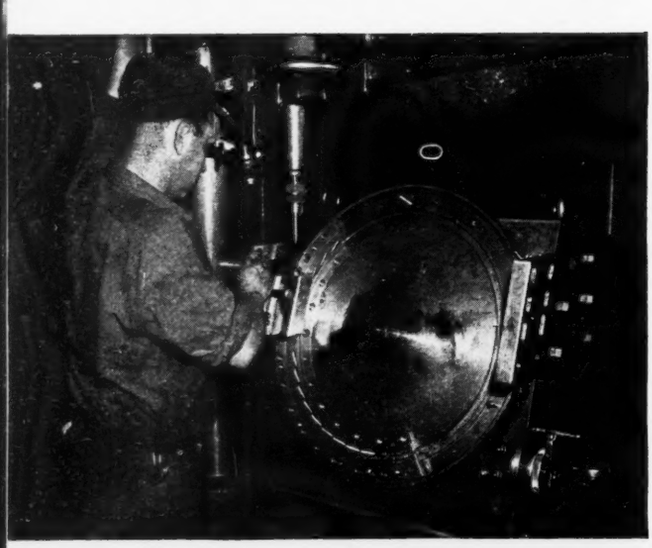


The Navy "E" Award to the Barberton Works for production achievement is "an honor not lightly bestowed and one to be cherished."

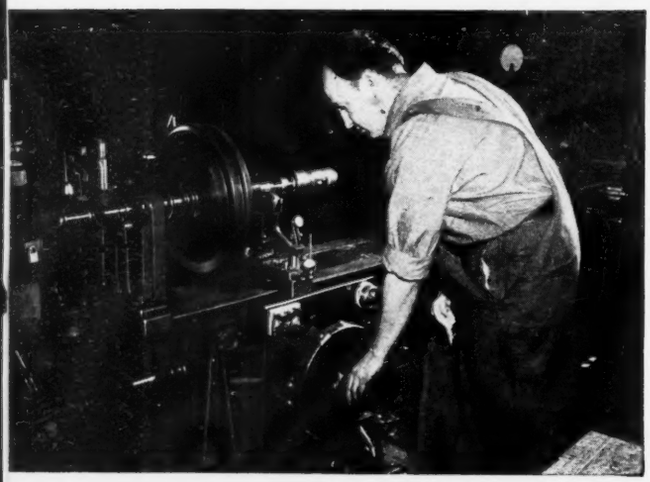
THE BABCOCK & WILCOX CO . . . . 85 LIBERTY STREET, . . . NEW YORK, N. Y.

BABCOCK & WILCOX

"We'll keep 'em coming—you k



Accurate reaming of nozzles has an important bearing on turbine efficiency.



Dynamic balancing makes a smooth running turbine.

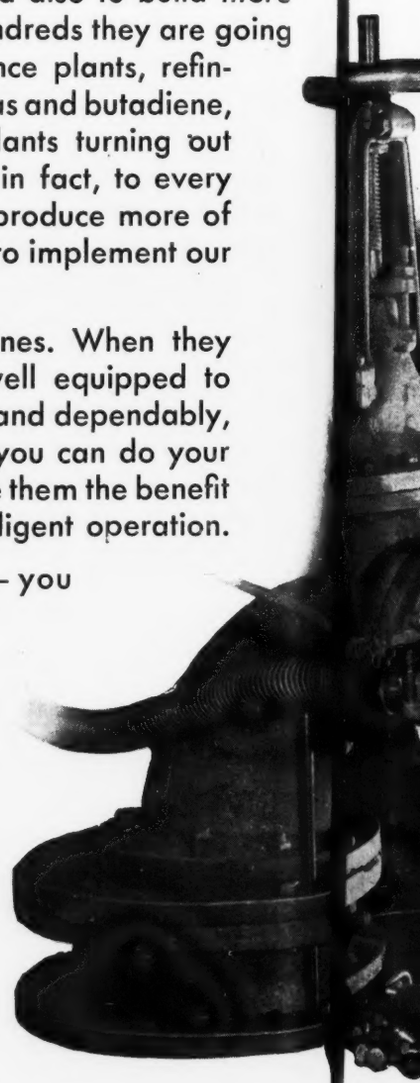
Disk has just been shrunk on shaft and is being checked for alignment.

Elliott men always did take pride in building good turbines.

Today, there is additional incentive to build good mechanical drive turbines, and also to build *more* of them, and *faster*. By the hundreds they are going out to powder plants, ordnance plants, refineries turning out high-octane gas and butadiene, to synthetic rubber plants, plants turning out aluminum and magnesium — in fact, to every industry which is straining to produce more of the things so urgently needed to implement our fighting forces.

We're building good turbines. When they leave our hands, they are well equipped to serve the war effort efficiently and dependably, 24 hours a day. We suggest you can do your part by treating them well, give them the benefit of proper inspection and intelligent operation.

We'll keep 'em coming — you keep 'em turning!



Elliott Company's line of mechanical drive turbines covers practically the complete range of required sizes, for steam conditions up to 600 lb. gauge and 750° F. Gears, built-in or separate, when required. Single-stage and multi-stage designs. We also build all-Elliott turbine-generator units from small sizes to around 10,000 Kw. Bulletins available on all these units. Write.

ELLIOTT COMPANY

Steam Turbine Dept., **JEANNETTE, PA.**

DISTRICT OFFICES IN PRINCIPAL CITIES

H-660

ELLIOTT *Mechanical*

keep 'em turning!"

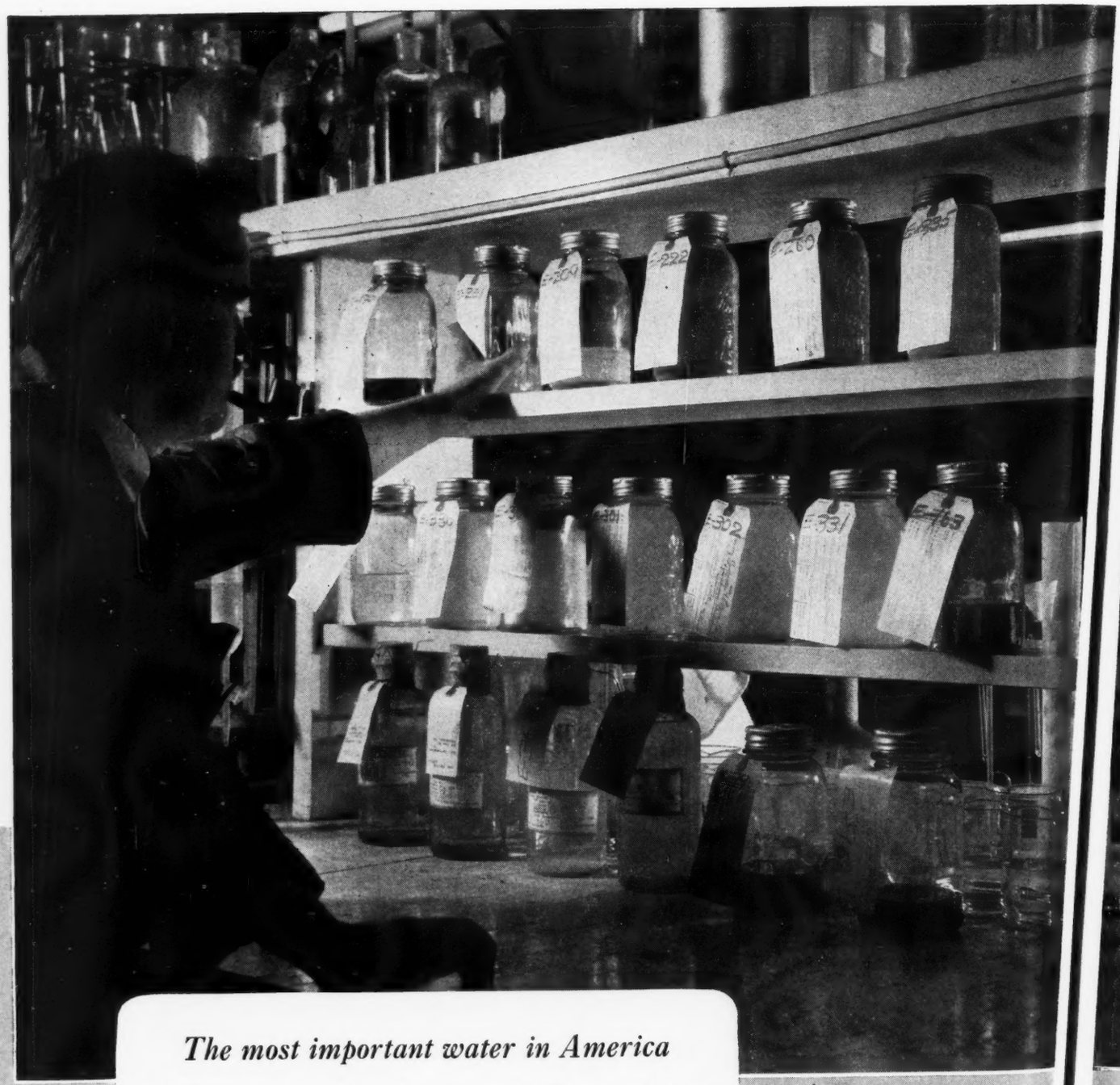
Water Brake Test

Vertical offset speed-reduction gear.

Assembling small single-stage turbine.

Drive TURBINES

This is no time to mince words



The most important water in America

Boiler water samples from a large army tank builder, four of the Nation's biggest steel mills, a large chemical plant, a major rubber company, a munitions manufacturer and other war plants. These steam plants and hundreds of others are producing 24 hours a day at top capacity with the aid of Hall Service.

over boiler water service!

Steam production is too vital to the war effort to rely on half-way measures

NO part of your equipment is more important to you today than that which produces your power. None is driven harder or put to more severe tests. None would probably be more difficult to replace. Coddle it. Conserve it. But for victory's sake, if trouble does arise, don't trust its correction to half-way measures. Don't experiment. Don't guess.

Half the boiler outages we are called on to correct needn't have occurred. Half the repairs and replacements can be traced to incorrect diagnosis of their cause. They occur because there isn't a preventive specialist on the job.

What preventive measures are you taking against the four major enemies of steam production . . . Scale – Corrosion – Carry-over – Embrittlement?

Here's one thing leading steam producers have found it profitable to do—investigate Hall Service. For it offers what might be called "preventive medicine for boiler plant ills" in the most complete and practical form possible to obtain, a service which has *nothing* to sell but knowledge . . . the "know how" to keep boilers on the line.

The men who head the Hall organization are the men who contributed so much to the basic principles of sound water conditioning . . . the men who did the pioneering in this field . . . the men of whose work it may be truly stated that *there is no boiler plant in operation today that has not in some manner benefitted by their research.*

Thousands of case histories of industries served by Hall Laboratories offer a collection of facts and experiences that cannot possibly be equalled. Hall clientele is a Blue Book list of hundreds of the most important plants in the country.

Too much of the victory effort depends upon the maintenance of production . . . too much depends upon your own plants' production to mince words over the vital question of water conditioning service. Unless you are sure you have the best you can obtain . . . that it is *unquestionably* scientific and practice-proven, it is not good enough for you in times like these.

If there is one thing you want today, it is to be ready with *plenty* and *in time* to meet the problems of steam production under trying conditions. We would be glad for the opportunity to show you how Hall Service can provide it.

HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH, PA.

HALL SERVICE IN A NUTSHELL

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full co-operation, Hall Service:

1. **Minimizes boiler outages caused by water.**
2. **Helps maintain highest efficiency.**
3. **Establishes non-embrittling water.**
4. **Minimizes carryover.**
5. **Prevents corrosion in boilers and associated equipment.**
6. **Prevents deposition in water lines and cooling systems.**

HALL SYSTEM of Boiler Water Conditioning

FEEDWATER DEAERATION -

..A Modest but Important Factor in Curtiss War Plane Production

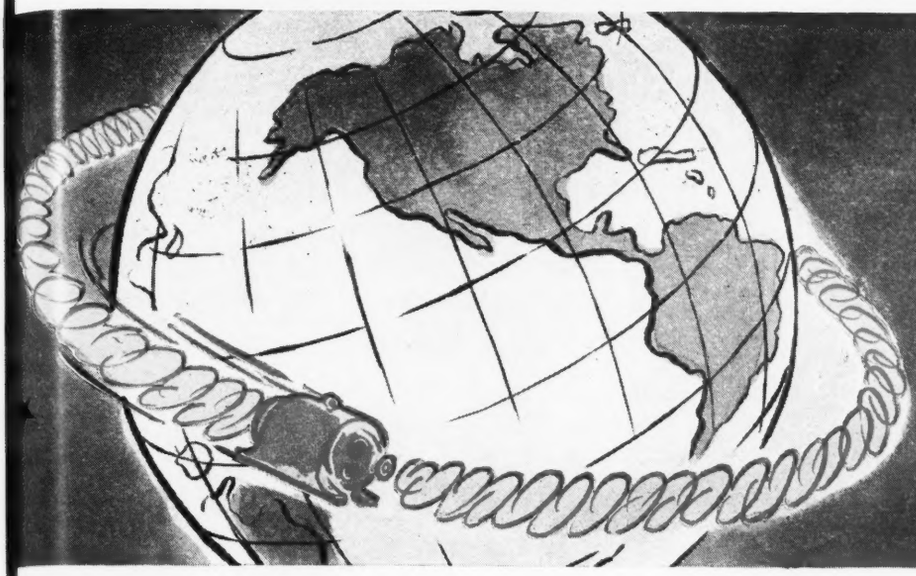
The great Curtiss Warhawk, latest of the P-40 type fighters swarming in ever increasing numbers over the battlefields of the world, is a tribute not only to the design but to the production genius of the Curtiss-Wright plants.

Cochrane has been privileged to contribute to this achievement by supplying several of the Curtiss-Wright plants with Cochrane Metering Deaerators of cast iron, caulked joint design and construction, the deaerating section mounted on a metering tank of similar design. The V-notch weir meter is electrically connected with a remotely located Cochrane Flow Meter Recorder.

COCHRANE CORPORATION
3106 N. 17th St., Philadelphia, Pa.

Cochrane

Wartime Problems



ROUND THE WORLD EVERY 8 DAYS!

That's the rim-travel of a rotor in many electric motors now working all around the clock on Victory production!

Motors that worked 1800 hours in a peacetime year are now working a full *8700 hours a year.* Result: problems of maintenance are *quadrupled.* And more...

For motors must receive *finer* care than ever. Whose motors last longest may have a lot to do with who *wins* this war!

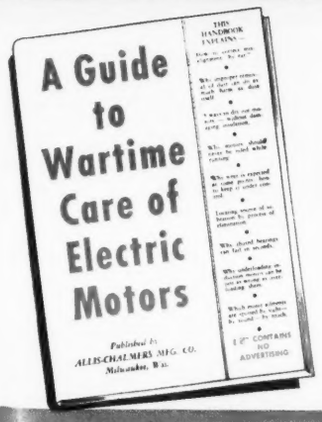
CALL FOR Wartime Solutions

AN ATTACK IS THE BEST DEFENSE

Taking the initiative against wear always has been sound maintenance practise. In wartime, it's a *vital* practise!

First, because wear now works *faster.* Second, because avoidable breakdowns *cannot be afforded* in the victory effort!

Beating wear to the punch is the basic principle of a new Allis-Chalmers publication: "A Guide to Wartime Care of Electric Motors." You'll find it *invaluable!*



Order This Free Book!

Every engineer, production manager and maintenance man will want a copy of "A Guide to Wartime Care of Electric Motors" for his technical library—and for immediate use, too!

It outlines the "natural enemies" of an electric motor and the most effective methods of combatting them. To be of maximum use to you, it applies to *all makes* of standard, general-purpose motors.

It's liberally illustrated — contains no advertising.

Tear out the order form now and send in to Allis-Chalmers for *your* free copy of this timely handbook.

ALLIS-CHALMERS MFG. CO.
Advertising Dept.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* "A Guide to Wartime Care of Electric Motors."

Name:.....

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Company:.....

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City and State:.....

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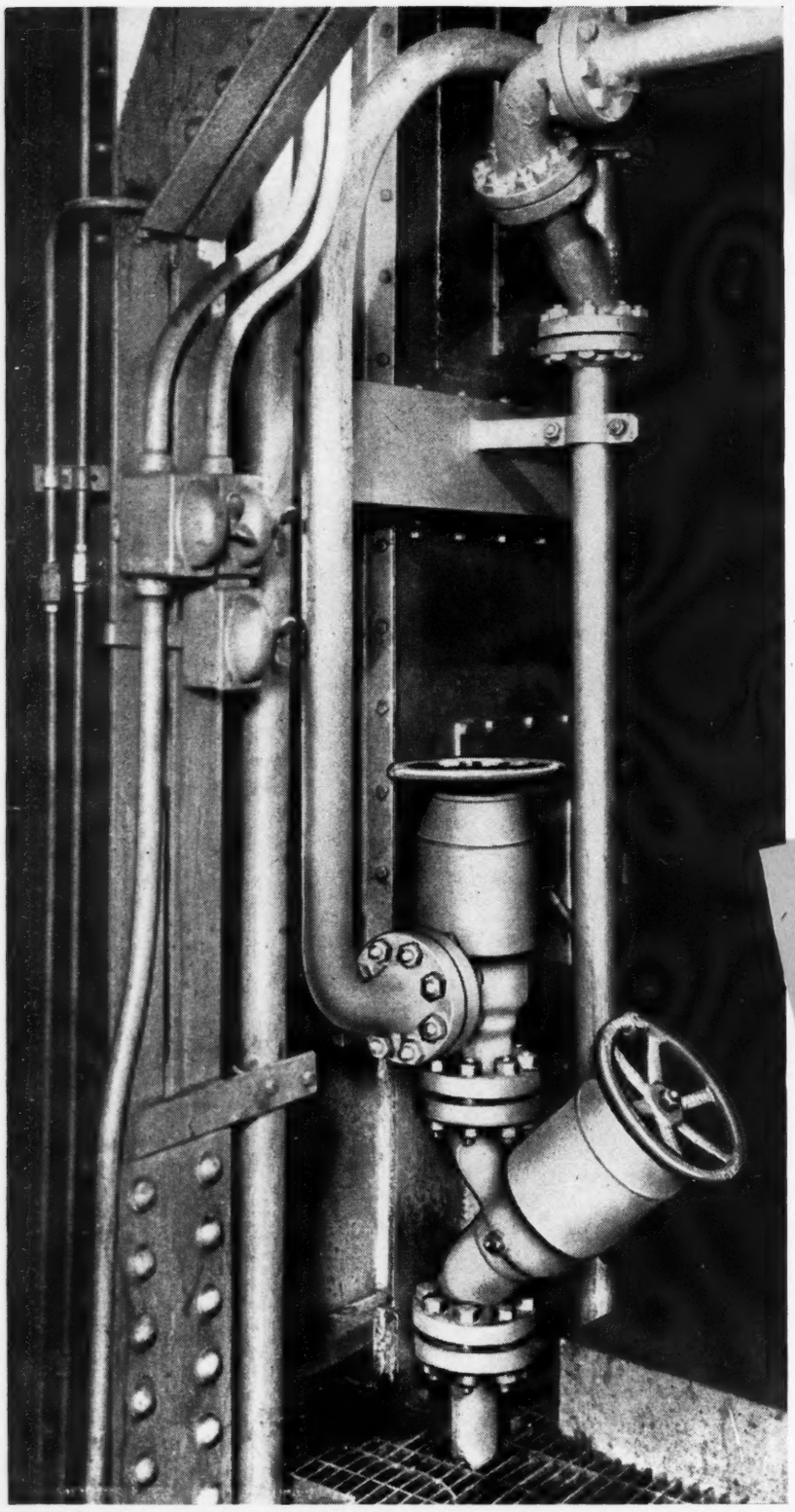
ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE

240 YARWAY



At left: Typical view of the Yarway Seatless Tandem Valves in use on the boilers at Cahokia Station. Note that these valves are equipped with dust guards—good protection against stem wear when dust is encountered.

PROPER MAINTENANCE WILL LENGTHEN THE LIFE OF VITAL VALVES. Make sure these simple precautions are a part of your plant routine. Lubricate your Yarway Valves often, using the convenient Alemite fittings provided. Keep yoke nuts tight. Close valves down hard. Care will prevent wear—further increase normal long life. Send for detailed Instruction Card.

YARWAY

SEATLESS VALVES at Cahokia Station

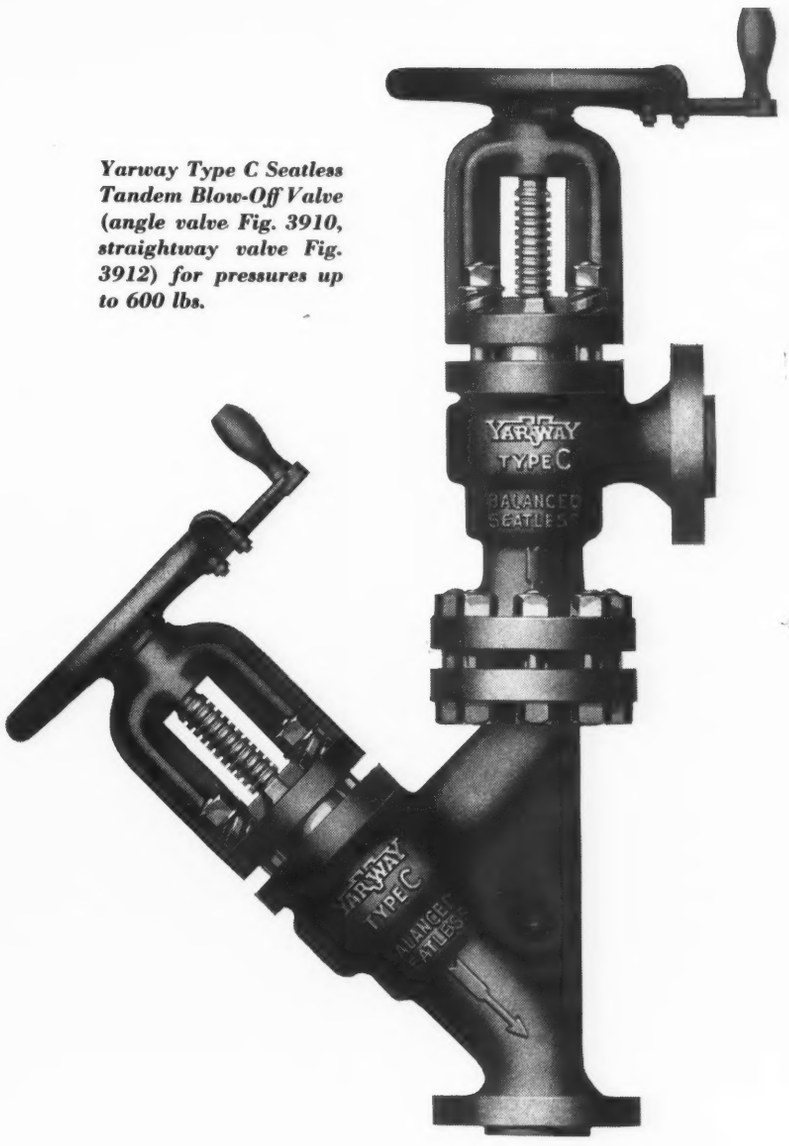
AT the Union Electric Company's Cahokia Station, near St. Louis, 240 Yarway Seatless Blow-Off Valves used in tandem are employed on main boiler blow-down lines and water-wall drains of the 24 Boilers operating at 350 lbs pressure. Some of these Yarway Valves have been in service as long as 14 years and are still giving a good account of themselves.

Good reason why, when this same outstanding utility company planned the new Venice, Illinois, Station, Yarway Seatless Blow-Off Valves were used on these 885-lb pressure units.

Years of service in low, medium and high pressure plants of leading utilities and industrials have proved the sound design and metallurgy of Yarway Valves for blowing-down or draining and for sealing.

What are your drain or blow-down valve requirements? Write for Catalog B-421 for pressures up to 400 lbs; B-431 for pressures up to 2500 lbs.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia, Pa.

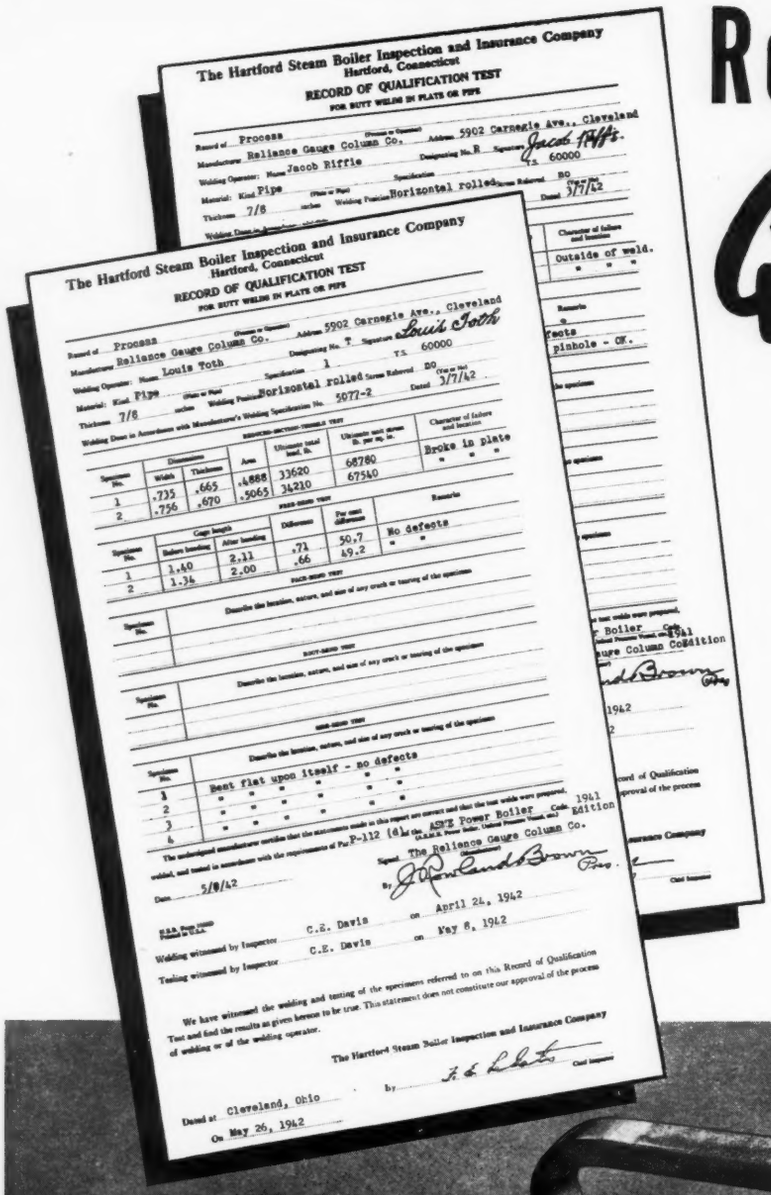


Yarway Type C Seatless Tandem Blow-Off Valve (angle valve Fig. 3910, straightway valve Fig. 3912) for pressures up to 600 lbs.

BLOW-OFF VALVES

Reliance meets *Qualified*

Your Assurance of Accident-proof Dependability in RELIANCE Boiler Safety Devices...


The Hartford Steam Boiler Inspection and Insurance Company
Hartford, Connecticut
RECORD OF QUALIFICATION TEST
FOR BUTT WELDS IN PLATE OR PIPE

Record of Process — Owned or Operated
Manufactured by Reliance Gauge Column Co. — Address 5902 Carnegie Ave., Cleveland
Welding Operator: Name Jacob Riffle — Designating No. R — Signature Jacob Riffle
Material: Kind Pipe — Specification — Grade — Class — Type — Normalized — No
Thickness 7/8 inches — Welding Position Horizontal rolled — Diameter — Dated 3/7/42
Welding Done in Accordance with Manufacturer's Welding Specification No. 5072-2

Specimen No.	Dimensions Width	Thickness	Area	Ultimate total load, lb.	Ultimate unit stress lb. per sq. in.	Character of failure and location
1	.735	.665	.4888	33620	68780	Broke in plate
2	.756	.670	.5065	34210	67540	" " "

FREE-BEND TEST

Specimen No.	Gage length Before bending	Gage length After bending	Difference	Per cent elongation	Remarks
1	1.40	2.11	.71	50.7	No defects
2	1.34	2.00	.66	49.2	" "

FACE-BEND TEST

Specimen No.	Describe the location, nature, and size of any crack or tearing of the specimen
1	Bent flat upon itself - no defects
2	" " " " " "
3	" " " " " "
4	" " " " " "

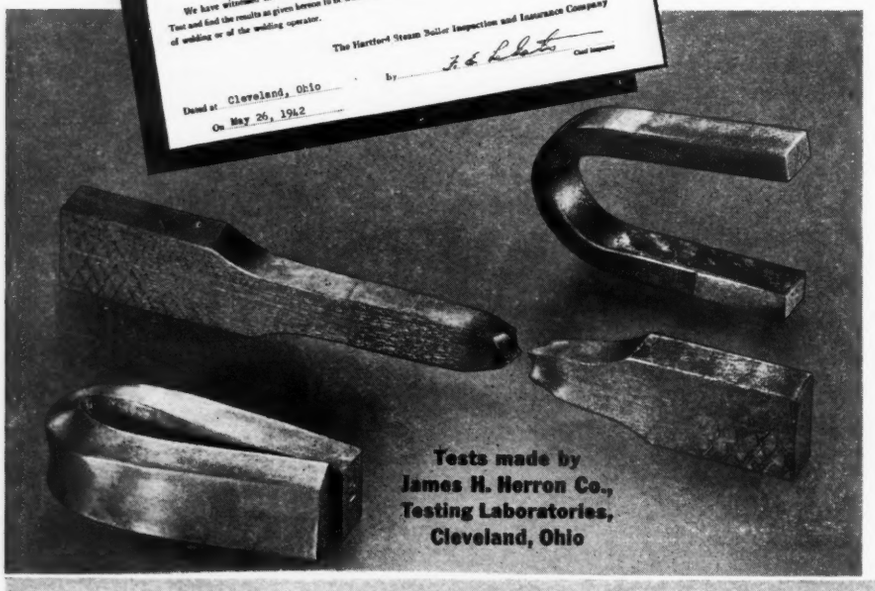
The undersigned manufacturer certifies that the statements made in this report are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Par. P-112 (d) of the ASME Power Boiler Code (A.S.M.E. Power Boiler, Unfired Pressure Vessel, etc.) 1941 Edition

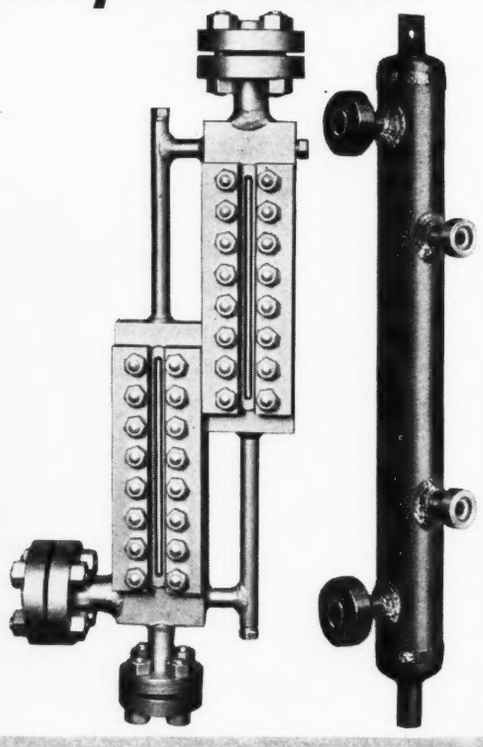
Signed The Reliance Gauge Column Co. (Manufacturer)
By J. R. Rowland Brown Pres.
Date 5/8/42

Welding witnessed by Inspector C.E. Davis on April 24, 1942
Testing witnessed by Inspector C.E. Davis on May 8, 1942

We have witnessed the welding and testing of the specimens referred to on this Record of Qualification Test and find the results as given hereon to be true. This statement does not constitute our approval of the process of welding or of the welding operator.

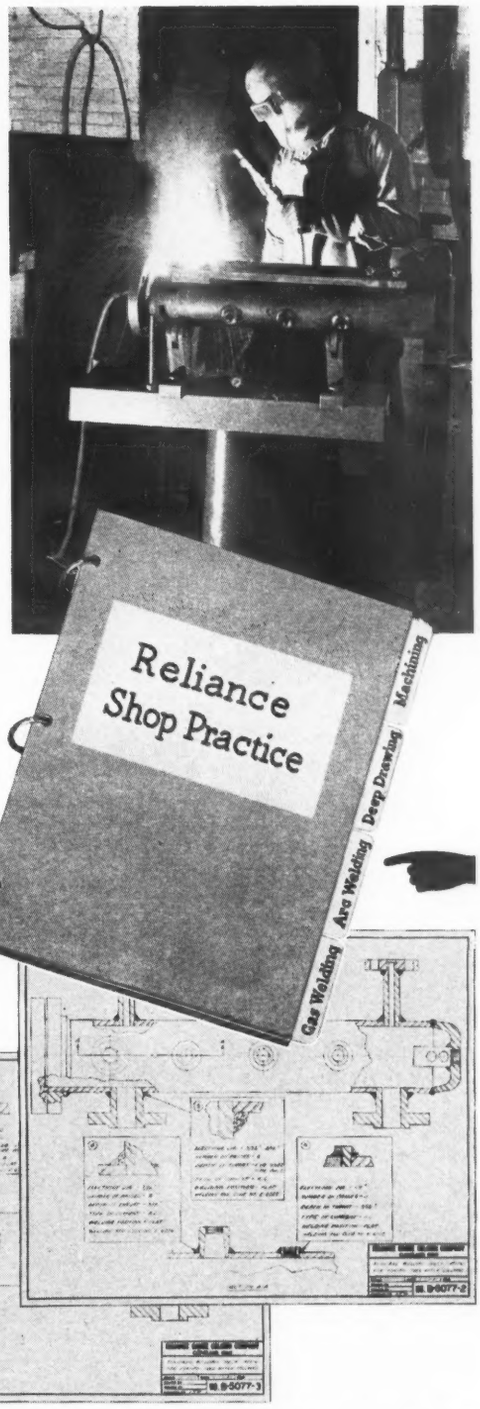
The Hartford Steam Boiler Inspection and Insurance Company
by F. S. Allen Chief Inspector
Dated at Cleveland, Ohio
On May 26, 1942


Tests made by
James H. Herron Co.,
Testing Laboratories,
Cleveland, Ohio



Reliance

A. S. M. E. Code Requirements with EXPERT WELDING



THE STEADY RISE in working steam pressures — doubling, trebling and quadrupling the recognized "low pressure" limit of 250 lbs. — has brought new designs and techniques in water column manufacture. At Reliance you find expert application of forged steel and seamless tubing construction, alloy metals, *electric arc welding,* precision tools and modern finishing processes. These apply not only to water column production but to the accessories — gage cocks, gage valves, gage inserts and illumination equipment.

Reliance complies with all applicable rules and specifications in Section I of the A. S. M. E. Boiler Construction Code, and meets the requirements pertaining to *electric arc welding,* including the addendum to Par. P-299 (a), recorded in the "Addenda to A. S. M. E. Boiler Construction Code, Power Boiler Code, approved by Council, The A. S. M. E. — Sept. 30, 1941."

Reliance welders produced welded samples shown in the photograph opposite. The samples were prepared and welded in accordance with the "Standard Qualifications for Welding Procedure and Welding Operator," Section IX A. S. M. E. Code. In addition, the qualification tests were witnessed by inspectors of The Hartford Steam Boiler and Insurance Company and all tests of the required samples were made by independent laboratories.

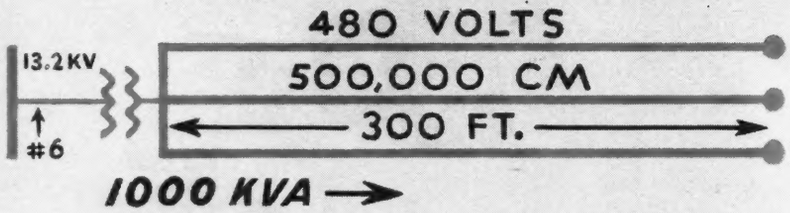
All Reliance welding procedures are covered by written standard practice and detailed diagrams. Letter of certification covering welding of products delivered is available to users upon request.

THE RELIANCE GAUGE COLUMN CO.
5902 CARNEGIE AVENUE • CLEVELAND, OHIO

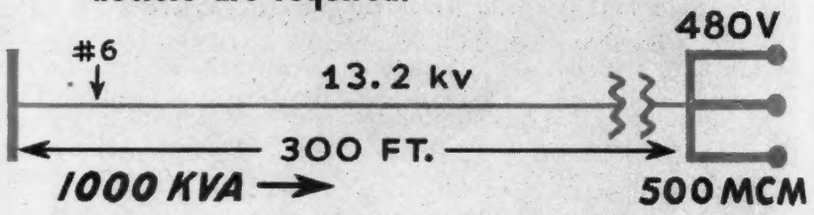
BOILER SAFETY DEVICES

To Conserve Copper

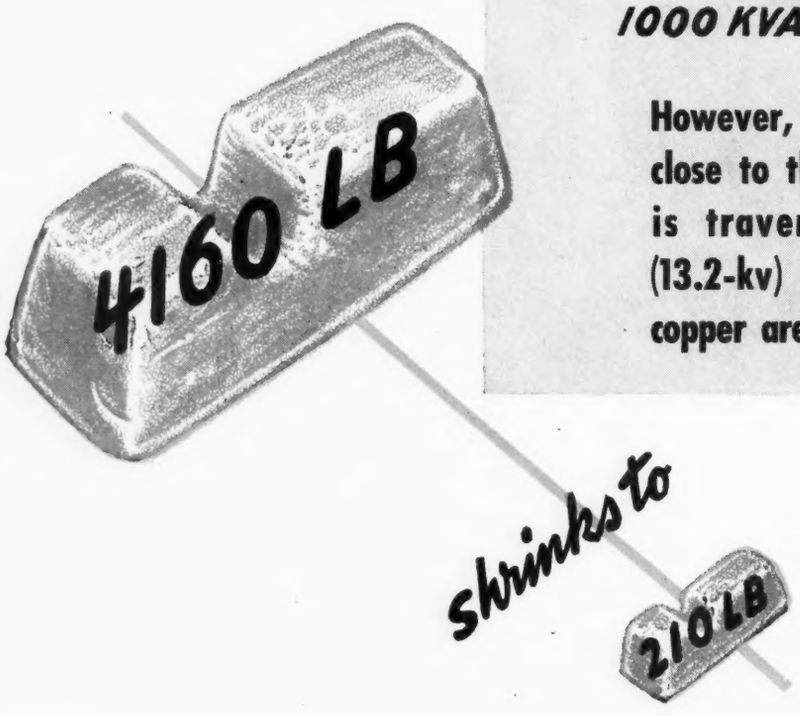
WITH our growing war effort demanding all available copper (and more), stringent conservation of this highly important metal is obviously imperative. War-plant electric systems offer many opportunities for conservation without adversely affecting the systems in any way. . . . . see example. →



If 1000 kva is supplied through 300 feet of low-voltage (480-v) feeders, 4160 pounds of copper in cable conductors are required.



However, by moving the substation up close to the load so that the 300 feet is traversed with a high-voltage (13.2-kv) feeder, only 210 pounds of copper are required.



To conserve copper, locate substations as close to the load as possible.

GENERAL ELECTRIC

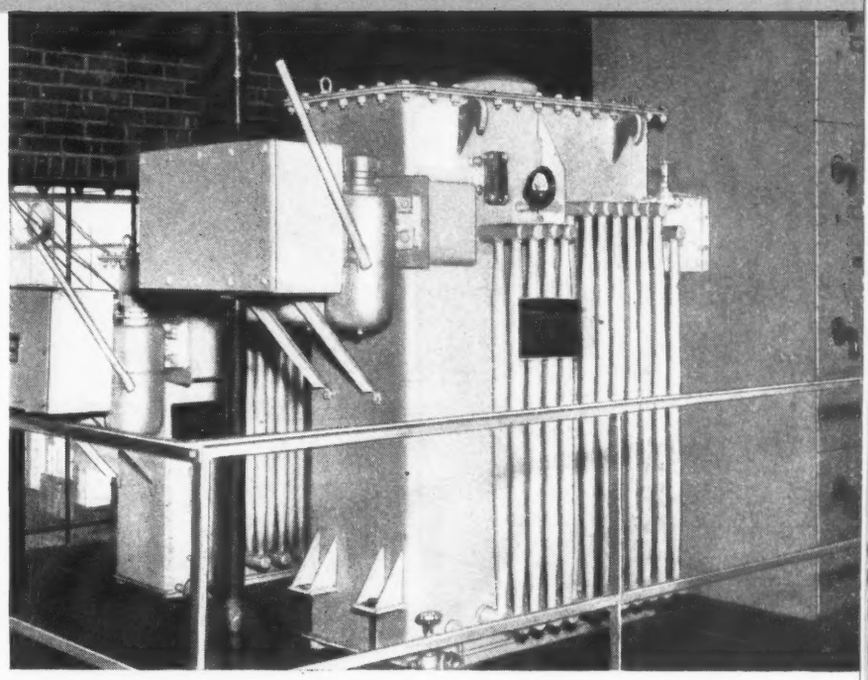
Cover As Much Distance with High-voltage Circuits As Possible

To really do this, you'll use unit substations at load centers — and they'll be small-size units

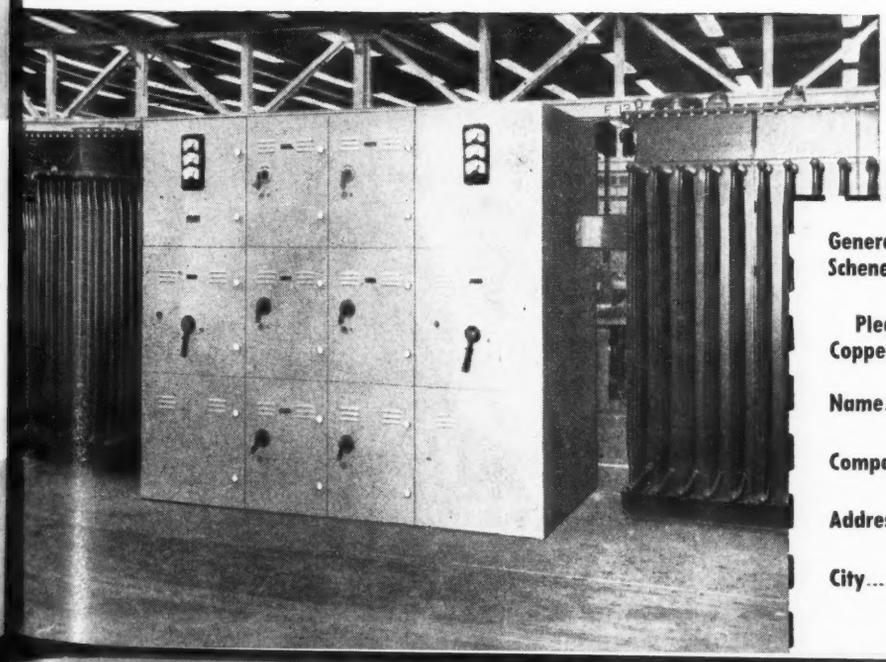
FACTORY-ASSEMBLED unit substations can be quickly installed at load centers right in working areas—with practically no loss of valuable floor space. Installing units at the centers rather than at the sides of load areas requires 30 to 40 per cent *less* copper.

By using four small unit substations rather than one large substation to serve a square load area, you can save one-half the amount of copper required by the latter. Safety metal-enclosed construction, along with Pyranol (G-E askarel) transformers, precludes the necessity of expensive vault construction.

There are other important ways of conserving copper in electric systems—cable copper, particularly. By distributing power at the highest practical voltage, and by using cable with high-temperature insulation, a considerable amount of copper will be saved. For an analysis of five ways to conserve tons of copper in war-plant electric systems, mail the coupon today.



These compact, "packaged" units require considerably less copper in themselves than old-style substations. They are readily installed over washrooms, along column centers, on sub-balconies, or in other comparatively valueless space. And they can be purchased more easily and quickly than "piecemeal" equipments.



The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment.

General Electric, Sec. C 302-12
Schenectady, N. Y.

Please send me a copy of your bulletin, "Five Ways to Conserve Copper."

Name .....

Company .....

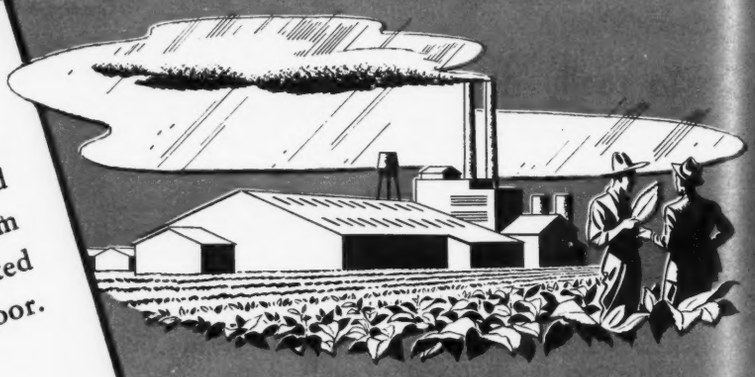
Address .....

City ..... State .....

5900 & 170E

WHEN PERFORMANCE COUNTS YOU CAN COUNT ON A-E-CO TAYLOR STOKERS

A CASE IN THE TOBACCO INDUSTRY



PROBLEM:

The situation at this plant was unusual. Firing equipment had to be selected which, burning the widest range of coals economically available, would operate at maximum efficiency with a minimum furnace volume. The existing plant was of limited height and had no basement below the firing floor.

SOLUTION:

Upon due consideration of the requirements, a Taylor Continuous Ash Discharge Stoker was installed under a 70,000 lb. per hour steam generator. No heat recovery equipment was purchased.

RESULTS:

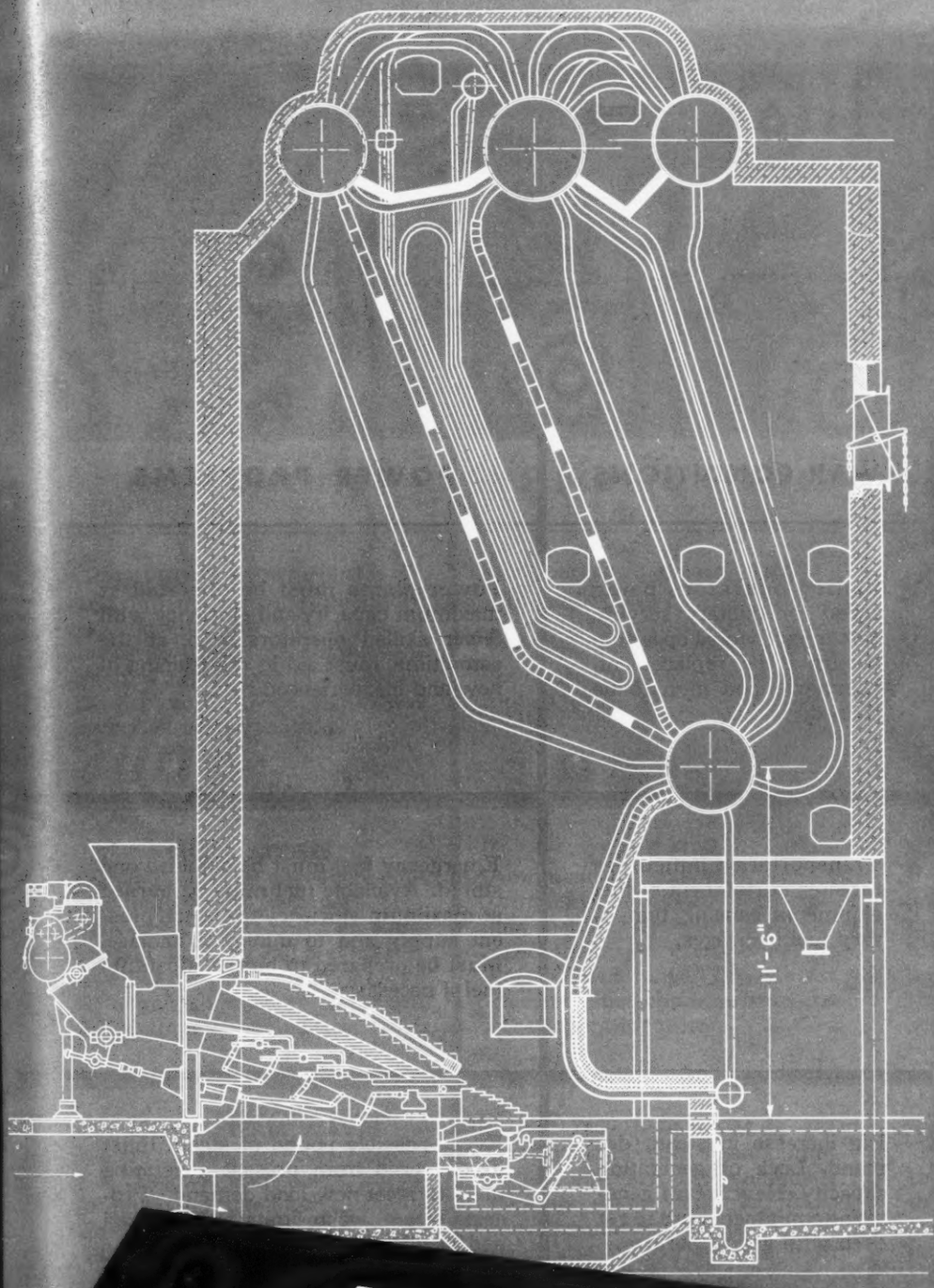
The unit was placed in service March 24, 1940. A recent report on performance from that date until April 30, 1942 disclosed 442,884,000 lbs. of steam generated from 45,311,280 lbs. coal (average evaporation; 9.77 lbs. steam per lb. of coal). The coal contained an average content of 13,890 B.T.U. per lb. as fired. Operating conditions; 410 lbs. pressure, gauge; 650°F. total steam temperature; 277°F. feed temperature to boiler. The combined efficiency of the unit was 79.9%. It is interesting to note that the unit was in service 17,448 of the elapsed time of 18,432 hours, or available 94.5% of the time.

CONCLUSIONS:

This case demonstrates two important advantages of the Taylor Stoker—its ability to burn a wide range of coals economically and the ease with which it can conform to limitations of space. By eliminating the need of new construction, the space advantage of the Taylor Stoker contributes to conservation of essential materials.

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA



A-E-CO TAYLOR STOKERS ON THE FIRING LINE

*Aluminum Company of America, Edgewater, N. J.
*Aluminum Company of America, New Kensington, Pa.
American Tobacco Co., Inc., Durham, N. C.
Castanea Paper Company, Johnsonburg, Penna.
Chrysler Corporation, DeSoto Plant, Detroit, Mich.
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company, Monroe, Michigan
*Cresson State Sanitarium, Cresson, Penna.
Defiance Milk Products Co., Defiance, Ohio
*DeLaval Steam Turbine Co., Trenton, N. J.
*Detroit Sulphite Pulp & Paper Co., Detroit, Michigan
City of Dover, Ohio
*Draper Corporation, Hopedale, Mass.
Erwin Cotton Mills Co., West Durham, N. C.
*Fisher Body Corporation, Detroit, Michigan
Fisher Body Corporation, Fleetwood Plant, Michigan
*Fisher Body Corporation, Grand Rapids, Michigan
*Fisher Body Corporation, Pontiac, Michigan
Fox Paper Company, Lockland, Ohio
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company, Lockland, Ohio
*General Electric Company, Erie, Penna.
*General Electric Company, Fort Wayne, Ind.
*Greenwood Electric L. & W. Plant, Greenwood, Miss.
*Board Public Works, Hannibal, Mo.
Hill School, Pottstown, Penna.
*Hobart Mfg. Co., Troy, Ohio
*City of Holland, Michigan
*Hope Natural Gas Co., Cornwell Station, West Va.
Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills, Rock Hill, S. C.
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Maybury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills, Lyman, S. C.
*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge, Cleveland, Ohio
*Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
*City of Richmond, Indiana
Sayles Biltmore Bleachery, Biltmore, N. C.
Scotten Dillon Company, Detroit, Michigan
Shelby Cotton Mills, Shelby, N. C.
Sloane-Blabon Corp., Philadelphia, Penna.
*Solvay Process Company, Detroit, Michigan
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
*Borough of Vineland, New Jersey
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*

A-E-CO TAYLOR STOKER

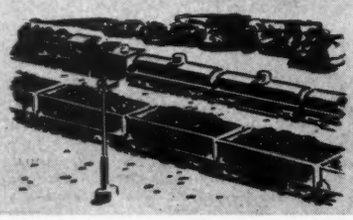
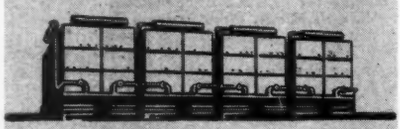
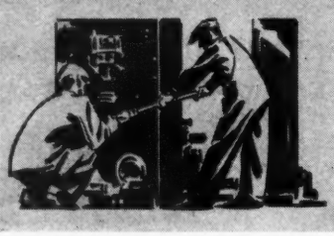
A-E-CO TAYLOR STOKERS
WATER WALLS · ASH HOPPERS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES
LO-HED HOISTS

COMPANY

BEFORE YOU BUY ANY FUEL FIRING EQUIPMENT CONSIDER EACH OF THESE 12 FACTORS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

First Aid Chart

	WAR CONDITIONS	POWER PROBLEMS
Manpower	Skilled operators being called for military service. Fewer experienced operators available for replacement. Inexperienced men to be trained.	Power plants must be operated at maximum capacity and efficiency with fewer skilled operators who, at the same time, must aid in the training of new and inexperienced men.
Fuel 	Transportation difficulties threaten curtailment of fuel shipments causing temporary fuel shortages.	Emergency fuel must be obtained and stored. Available fuel must be burned at maximum efficiency to stretch present supply and to minimize haulage. Must be prepared to burn a substitute fuel if necessary.
Steam 	Big increase in steam demand. Lack of generating capacity. New steam generating equipment hard to get even with good priorities.	Every possible pound of steam must be squeezed from present generating units to meet new load demand. Process steam waste must be checked and held to a minimum.
Maintenance 	All equipment operating at overload. No stand-by equipment. Replacement parts difficult to obtain. Inexperienced operators.	Maintenance and repairs must be taken care of promptly, in spite of a shortage of experienced maintenance men or difficulties in getting materials, in order to avoid major shut-downs.

REPUBLIC
INSTRUMENTS
AND CONTROLS

FOR SOLVING WARTIME POWER PLANT PROBLEMS

THROUGH the use of instruments and controls you may be able to increase your steam supply just enough to get it over the peak. Republic engineers will be glad to consult with you. Write to us today.

INSTRUMENTS	BOILER CONTROLS	PROCESS CONTROLS
IMPROVE SUPERVISION Instruments provide operators with continuous indications of operating conditions. Permit centralized supervision of all operating factors. Provide continuous record of performance.	**CONSERVE MANPOWER** Automatic boiler controls, by performing the routine repetitive adjustments, free the operators for more important supervisory duties.	**STRETCH SKILL** Automatically perform routine repetitive adjustments to maintain desired conditions thereby enabling the operator to surpervise the operation of a larger number of units.
CHECK LOSSES CO_2 meters, draft gages and flue gas temperature recorders provide a continuous check on combustion efficiency and preventable heat losses. Steam meters serve as a guide for the proper load distribution among boilers.	**SAVE FUEL** Automatically maintain highest combustion efficiency by controlling fuel and air input, in a fixed predetermined ratio, over the normal load range. Provide for changes in fuel characteristics and other operating factors.	**REDUCE WASTE** For every pound of steam wasted and for each extra gallon of water pumped, etc., a corresponding amount of fuel had to be consumed in the boiler room. Automatic controls reduce power waste and thereby save fuel.
CHECK STEAM WASTE Meters installed on main distribution lines will immediately center attention on the department or unit using excessive amounts of steam. They provide the information needed to coordinate steam consumption with steam production.	**TEST EFFICIENCY** Produce maximum steam output at test efficiency by maintaining constant steam pressure, maximum combustion efficiency, constant and correct furnace draft and desired load division among boilers.	**MORE STEAM** By reducing the power consumption of pumps, compressors, dryers or other steam consuming units, through the use of automatic controls, you increase the effective capacity of your power plant.
LOCATE TROUBLE SPOTS Instruments, by providing a check on the performance of various units, are invaluable in spotting potential trouble spots before they develop to a point where they require extensive repairs and interfere with production.	**REDUCE OUTAGES** Correct boiler operation reduces outages. Boiler controls, by coordinating all operating factors, prevent the chain-of-events type of trouble that may lead to serious shut-downs.	**UNIFORM PERFORMANCE** Maintain correct process conditions under continuous operation at peak capacity. When both operators and equipment are working at capacity close control is vital to prevent serious maintenance outages.

Republic Flow Meters Co.

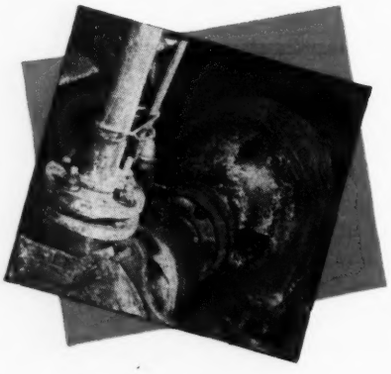
2222 Diversey Parkway • Chicago, Illinois

NEED MOTORS 4 things to do

use standard, open, sleeve-bearing motors whenever possible . .

The standard Tri-Clad motor, though classed as an "open" motor, is so well protected that it gives good service on many jobs for which specially protected motors previously were recommended. (See below.)

Sleeve-bearing motors often can be supplied more readily than ball-bearing types because of the present demand for ball bearings on other war equipment. Use ball-bearing motors only on applications where load or mounting conditions definitely require them.



Special end shields and other modifications may result in delay for you and others doing war work.

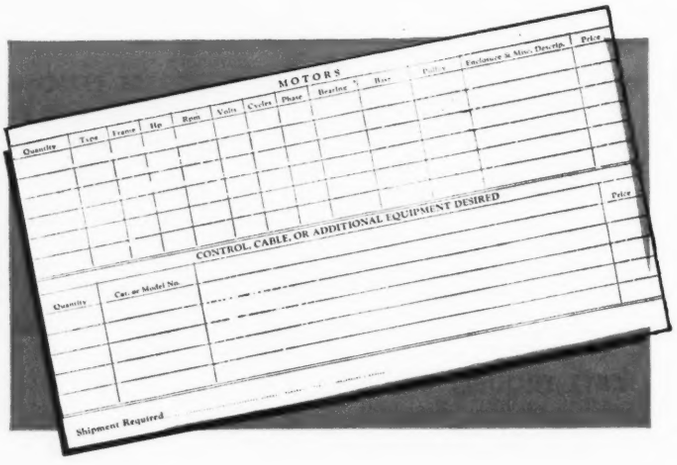
Consider the use of standard or multi-speed a-c motors in place of d-c wherever this alternative is possible.

order motors early . . giving complete specifications . .

Place motor orders when you order the machines they are to drive.

If you are planning motor drives for conveyors or other equipment for new plants, place orders as soon as design work indicates the motor requirements.

Avoid delay and "mix-ups" by giving complete specifications as shown in table below, preferably on an order form which your G-E motor representative can supply.



Tri-Clad motors are available in a full range of sizes from 1 to 100 hp. Your General Electric representative can supply complete information, and help you get the Tri-Clad motor to do your job. General Electric, Co., Schenectady, N. Y.

YOUR AID ON THESE 4 POINTS WILL HELP US PRODUCE AND DELIVER MORE MOTORS

YOUR CHOICE OF G-E TRI/CLAD MOTORS WILL GIVE YOU EXTRA PROTECTION AGAINST (1) PHYSICAL DAMAGE, (2) ELECTRICAL BREAKDOWN, (3) OPERATING WEAR.

for WAR WORK?

to get them quicker

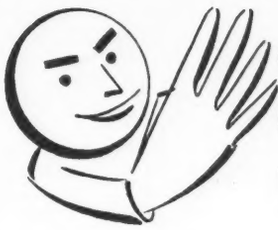
give complete priority information properly endorsed..

The filling of many motor orders is delayed because of incomplete priority information. If in doubt about details, call your local G-E office.

When placing orders for motors, be sure that complete priority data accompanies ***each order*** in the form of certificates, endorsements properly signed, etc. The priority is not effective in scheduling shipment until received by your supplier.

Your needs and the war effort are best served by using the proper priority rating as assigned by the War Production Board for the job involved and requesting delivery no earlier than actually required.

Builders of motor-equipped machines for subsequent sale may order their requirements in advance under the Production Requirements Plan.



check with G. E. for delivery from local warehouse stocks..

To meet urgent war needs, a supply of standard Tri-Clad motors is maintained at G-E factories and local G-E warehouses. Perhaps the motor you want, or can use with a few simple changes, is available for immediate shipment.

Your local G-E motor representative can furnish information on motors which may be in stock in the following cities:

Atlanta, Ga.	Los Angeles, Calif.
Boston, Mass.	Milwaukee, Wis.
Buffalo, N. Y.	Minneapolis, Minn.
Charleston, W. Va.	New York, N. Y.
Chicago, Ill.	Oklahoma City, Okla.
Cincinnati, Ohio	Omaha, Neb.
Cleveland, Ohio	Philadelphia, Pa.
Dallas, Texas	Pittsburgh, Pa.
Davenport, Iowa	Portland, Ore.
Denver, Colo.	St. Louis, Mo.
Detroit, Mich.	Salt Lake City, Utah
Houston, Texas	San Francisco, Calif.
Kansas City, Mo.	Seattle, Wash.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

Specify TRI-CLAD *Motors*

REG. U.S. PAT. OFF.

GENERAL ELECTRIC

750-128-8030

FOR MANY S
VALVES WILL

Fig. 1640 "KING-CLIP"—a sturdy iron body gate valve with internal working parts of bronze, for hard and continuous usage. It has wide application in industry and in many cases will serve as well as a bronze valve.

Fig. 1021 "FERRENEWO"—an iron body bronze mounted globe valve for numerous services. All parts are renewable and the seat and disc are easy to regrind. An excellent valve with low upkeep cost.

LUNKENHEIMER V

ERVICES THESE IRON BODY SERVE AS WELL AS BRONZE

and with proper priorities, you are likely to get better deliveries . . . .

The availability of bronze valves is becoming an increasingly critical problem, because of the scarcity of copper, tin, and other vital materials necessary in their manufacture. We recommend consideration of these iron body "King-clip" and "Ferrenewo" patterns as alternates.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnished the highest possible preference ratings and proper ''end use'' Allocation Classification Symbols on their orders. This will be of mutual helpfulness.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

Your Lunkenheimer distributor has a supply of Catalog 78. Ask for your copy.

VALVES BOILER MOUNTINGS LUBRICATING DEVICES

28-99-42

DOWTHERM
PROCESS HEATING

ACCEPTANCE

750% increase in 2½ years

For five years Industry tested Dowtherm process heating systems.

The growth was steady—the results excellent.

Then Industry realized—a new method—lower pressure, closer temperature control, better products.

Dowtherm had proved itself!

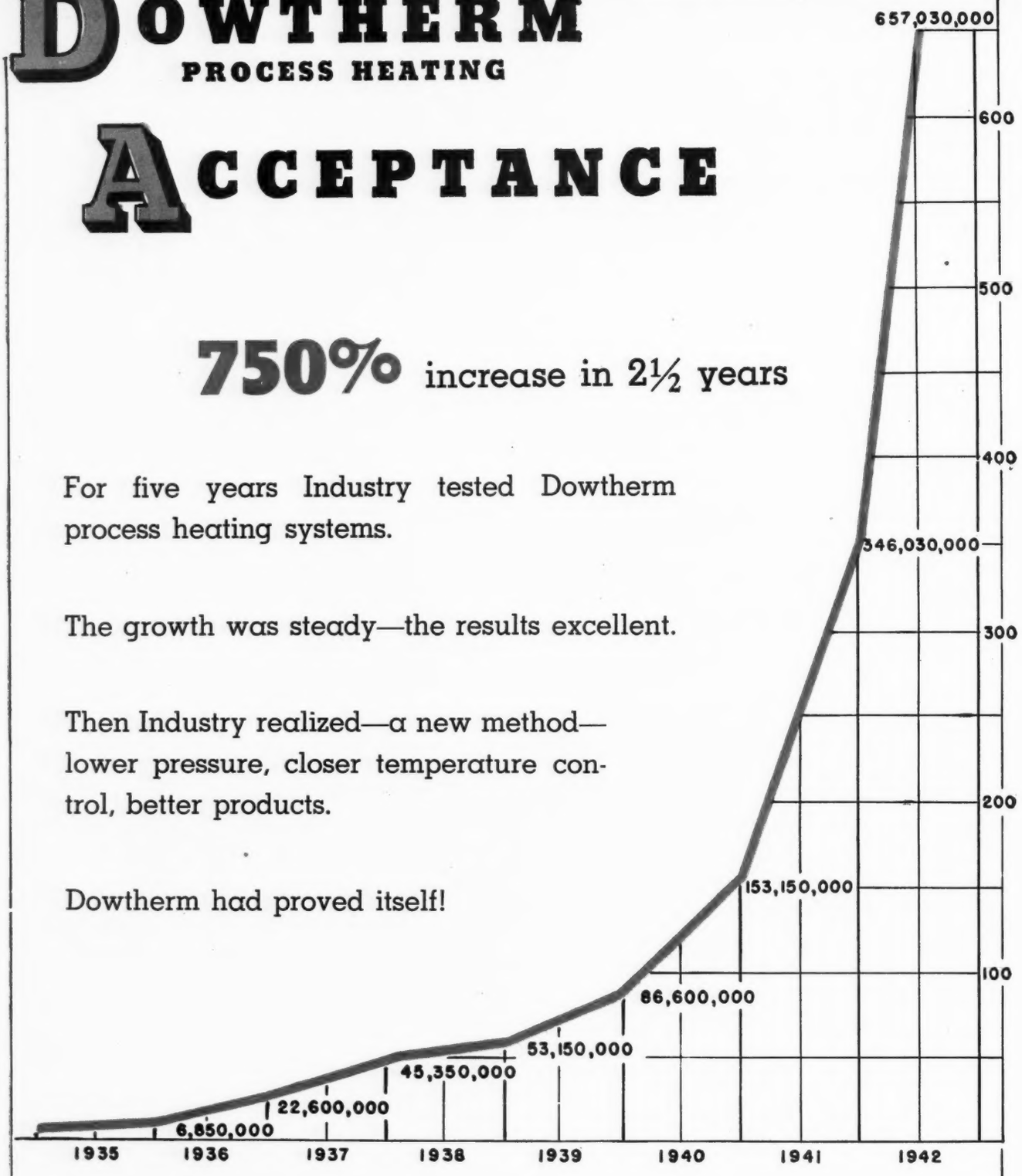


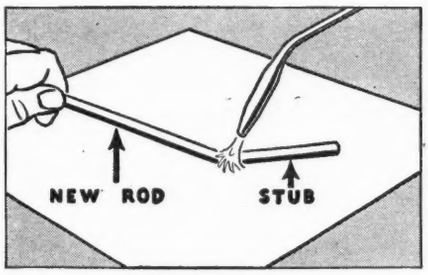
Chart of cumulative capacities of Foster Wheeler Dowtherm vaporizers in millions of B. T. U. per hour.

Foster Wheeler Corporation, 165 Broadway, New York, N. Y.

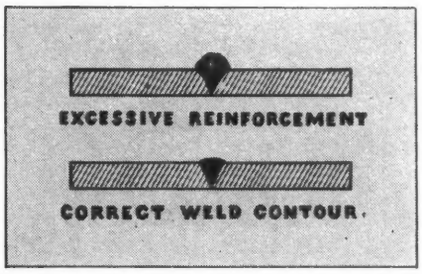
FOSTER WHEELER

Make Every Effort to Conserve Oxy-Acetylene Welding Rods

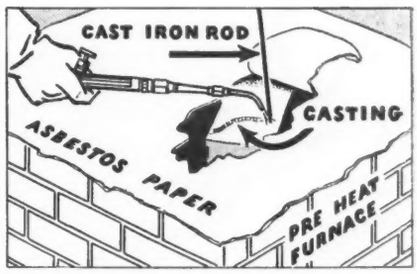
Welding rods, like all products made of materials that are strictly rationed, are subject to certain limitations of manufacture and sale. This is particularly true of rods that are made of bronze, copper, or alloy steels. In order to assure continued adequate amounts of these rods for war production, it is necessary for everyone to make every effort to conserve welding rods to as great an extent as is possible. Outlined here are some suggestions to help you to do this.



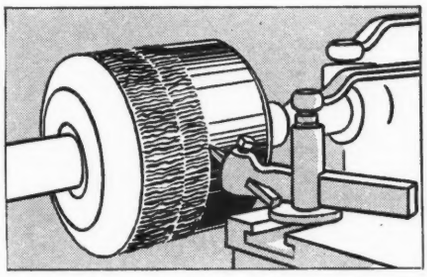
1. *Use up Stub Ends* of welding rods. This can be done by tacking them to the ends of new rods as work progresses, or by providing a container into which they can be placed for subsequent joining.



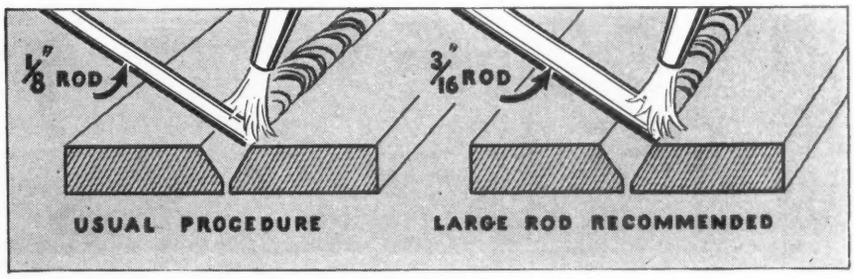
2. *Avoid Excessive Reinforcement* of the weld. Excessive reinforcement not only wastes welding rod, but also tends to set up strains and stresses in and around the weld which actually will weaken the joint.



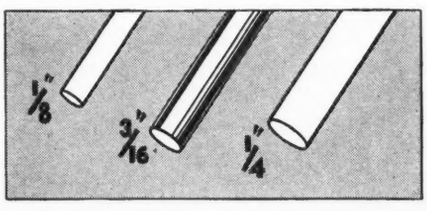
3. *Don't Use Bronze Rod* for work on which steel or cast iron rods will do the job. Of all the many types of welding rod, the bronze rods are most important to conserve. A cast iron repair job is shown above.



4. *When Depositing Bronze Rod* for resurfacing worn areas which are subsequently to be machined, hold the bronze deposit to minimum tolerances. This will prevent waste of both bronze and machining time.



5. *Use Larger Rod Sizes* whenever possible. Large rods are more readily available than the smaller sizes, because there is less call for them and because they tax the production facilities of rod mills less than does an equal tonnage of rods of smaller diameter. By working a little faster and with a slightly larger flame, a rod of larger diameter can be used with equally as good results as though a rod of the customary size were used.



6. *Reduce the Number of Rod Sizes* when ordering rod. If, for example, you normally order rod in sizes 1/8 in., 3/16 in., and 1/4 in., perhaps you can operate equally well by eliminating the 1/8 in., and 1/4 in. sizes. When the rod sizes you normally require are not readily available, use what you have or can get. This avoids delays and reduces the amount of rod tied up in inventory.

7. *Send for Reprints of This Page* for distribution in your shop. Your operators and supervisors can use them as "check lists" to make sure everything possible is being done to avoid waste of materials. We also will be glad to supply colored posters for posting on your bulletin boards to remind employees of the vital need for prompt return of empty oxygen and acetylene cylinders.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York Offices in Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

What happened WHEN HE SWITCHED TO—PROTEIN *for eliminating Boiler Scale?*

He is an engineer in a large New England Gas Plant. For years, his was the old problem—he listened to our story, about the advantage of Protein Acid Phosphate over Soda Acid Phosphate—he decided to give Phoscaloid a workout. This was started in December, 1935.

THE STORY IN A NUT SHELL

DECEMBER, 1936, he reported: "Internal inspection showed satisfactory results."

MARCH, 1937: "Drums, tubes, and nipples free from all scale."

FEBRUARY, 1938: after a through internal inspection of one of his boilers, it was labelled "a honey", perfectly clean.

FEBRUARY, 1939: inspection of Nos. 1 and 4 boilers, "found them with no appreciable depositions in tubes or drums, brought the statement: "of course, we vere very much pleased with the internal conditions of these boilers".

JANUARY, 1940: "We recently examined one of the B & W Boilers which had been in operation more than 240 boiler days, and found it in excellent condition".

MARCH, 1940: "Three other boilers were found to be as good as the first reported".

MARCH, 1941: "the three drums were perfectly clean and free from any deposits, or evidence of corrosion—the tubes being only slightly coated with liquid mud, which washed washed off cleanly".

CYRUS W. RICE & CO., INC.,

ACID PHOSPHATE

THIS METHOD WAS UNKNOWN PRIOR TO 1935

NOW . . .

IT HAS NATION-WIDE ACCLAIM

We have in our record files, many, many cases similar to those reported on the opposite page. The nice thing about these cases, is that results of this kind with Phoscaloid are possible with any kind of feed water,—and at a cost surprisingly low. The combined sludge-removing and greater reaction value of the colloids in Phoscaloid for calcium and magnesium in boiler waters are the responsible agents for these remarkable results.

Use the coupon, please, for a complete story of the development and success of this modern way to treat boiler feed waters.

Use the coupon, please,

for a complete story of the development and success of this modern way to treat boiler feed waters.

CYRUS W. RICE & COMPANY, INC.—PITTSBURGH, PA.

You may send me a copy of "Silica vs. Phoscaloid"—the Story of Phoscaloid's Development.

NAME

COMPANY

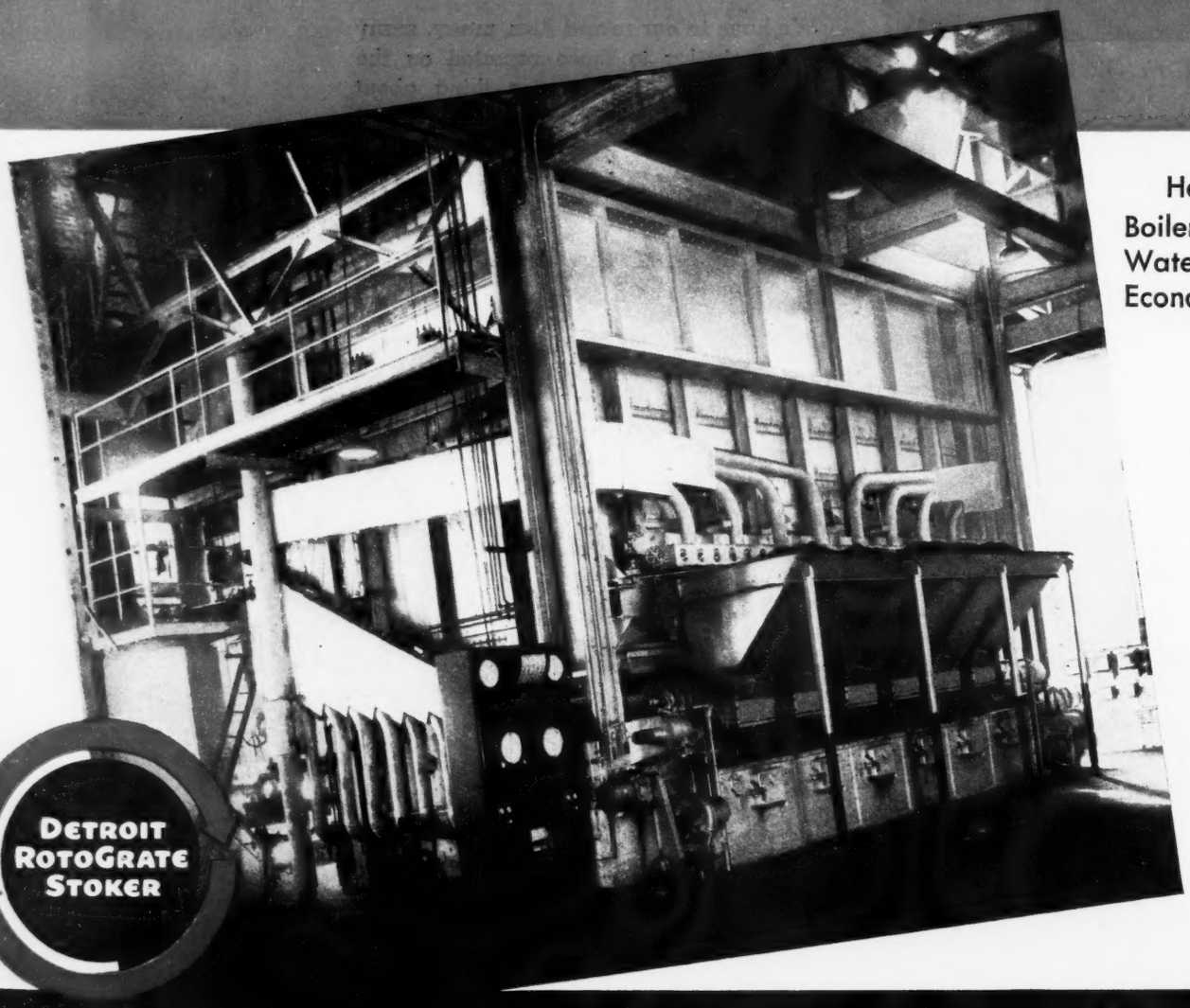
ADDRESS

CITY

STATE

Pittsburgh, Pa.

DETROIT ROTOGRATE STOKER

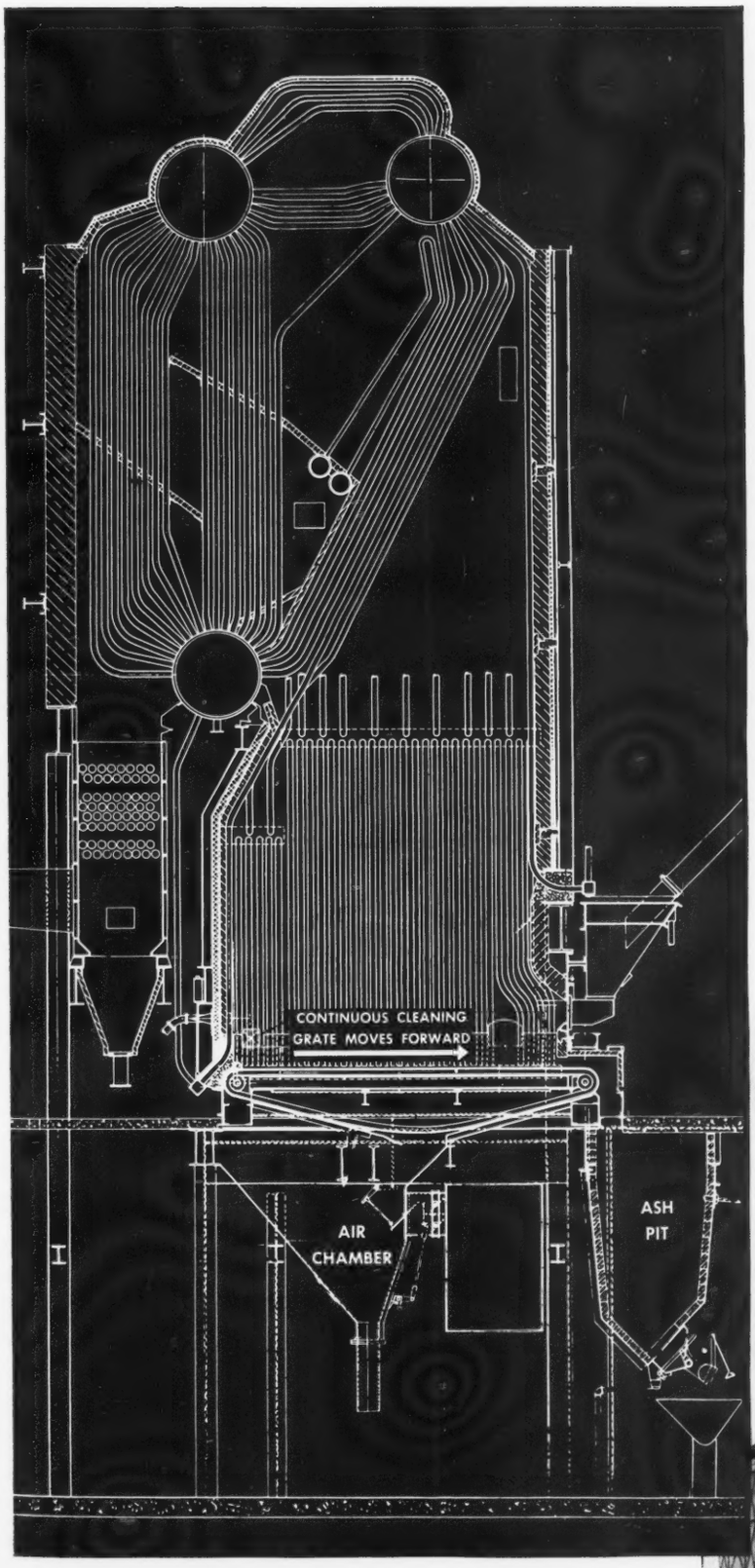


Heating Surfaces:

Boiler	18,800 sq.
Water Walls	2620 sq.
Economizer	4608 sq.

DETROIT STOKER COMPANY

at Studebaker . . .



• In 1940 Studebaker Corporation selected the RotoGrate for Main Plant, South Bend, Indiana.

Reason: The proven ability to burn any available coal at high burning rates.

• In 1941—Eight additional RotoGrate Stokers were installed in three other Studebaker plants.

• This year, R. N. Bucks, Superintendent of Power, reported at Midwest Power Conference, Chicago:

"1. RotoGrate was operated almost continuously since November, 1940, with only six outages of two days each, for general inspection.

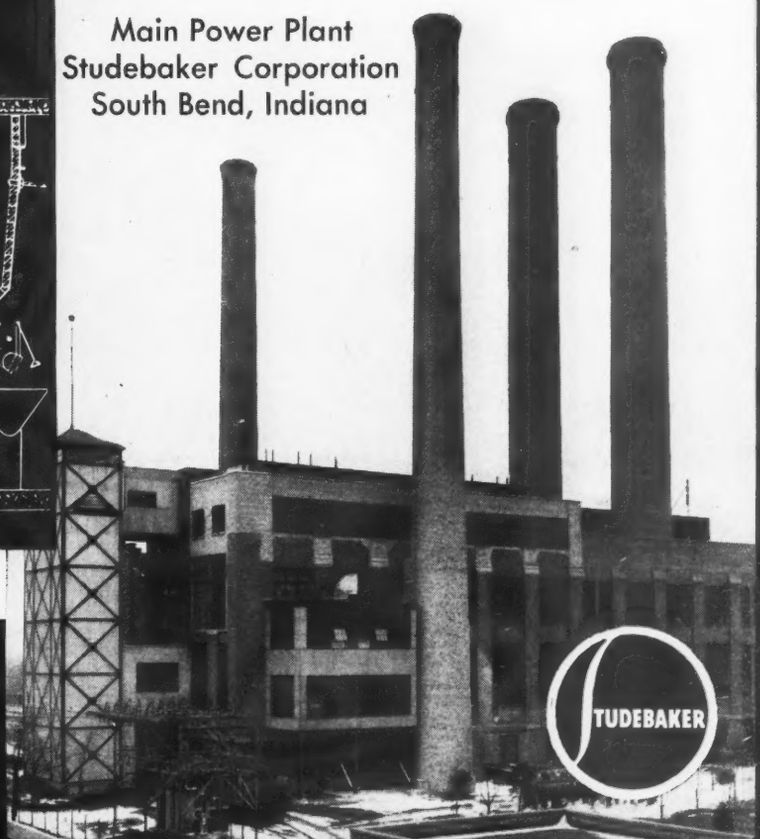
2. Over 50,000 tons coal from seven different Illinois, Indiana and West Virginia Mines (raw screening coals 1-¼" by 0) were burned.

3. Average efficiencies for 1941:

Monthly, 80.5% to 84.4%
Annual, 82.4%

4. Load range varies from 35,000 to 225,000 pounds of steam per hour."

Main Power Plant
Studebaker Corporation
South Bend, Indiana



Sales & Engineering Offices

General Motors Building • Detroit, Mich.

...excerpt from a letter marked "PERSONAL"

I've marked this letter "Personal," not as a trick to attract your attention, but because it must take the place of a personal call that I've tried to find time to make—without success.

We are busy at Foster. In a few all-too-short months, we have changed our entire organization from a private enterprise to a tireless war machine. We, too, have gone all out — not merely for defense, but for *victory*.

We realize that this change has effected our "normal" business relations with many of our customers. But these are not "normal" times . . . we *must* avoid too little, too late—war work *must* come first here just as it does in your plant.

We have not forgotten our old customers. We can still make valves for you—but if we seem slow in answering your inquiry; if our delivery dates seem unreasonable, be assured that it is not indifference, not a lack of appreciation of past favors.

It's simply that we're "in" on this business of winning the war —and when the war is won, we will be back "on schedule."

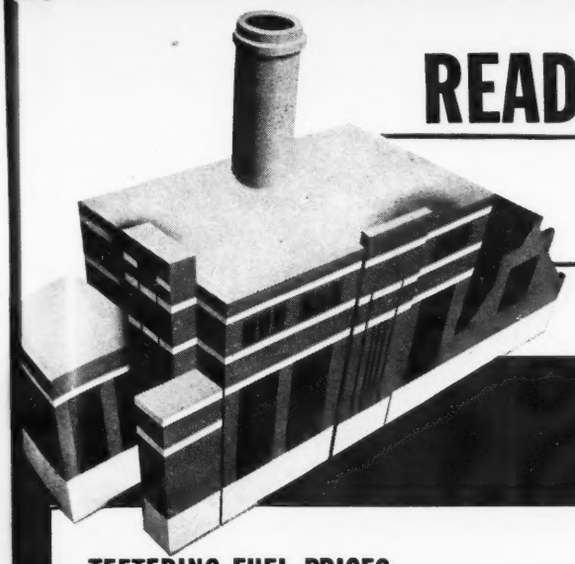
FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

109 MONROE STREET • NEWARK, N. J.

9-FE-1

READ THESE SOLID FACTS ABOUT WATER-COOLED STOKERS



TEETERING FUEL PRICES, STACK DISCHARGE, AND LOAD "SWING" BRING DECISION TO WATER-COOLED STOKERS

A certain mid-west plant had to be prepared for burning eastern or Indiana fuels as decreed by slight variations in price. Needed, too, was equipment capable of efficiently following the typical "swings" of municipal loads . . . and minimum stack discharge.

Bids for all types of firing were carefully examined. Taylor Water-Cooled Stokers presented, through examples of actual operation, the most acceptable solution. Thus Taylor Water-Cooled Stokers were installed under a 100,000 lbs. per hour steam generator.

The Results Speak for Themselves

Period	March 14, 1939 to Dec. 31, 1941 Incl.
Total steam generated	1,308,454,600 lbs.
Total coal burned	154,901,500 lbs. (77,450.75 tons)
Average actual evaporation	8.44 lbs. S/lbs. Coal
Operating conditions	435 lbs. G.; 700° T.T. 280° Feed to Econ.
Average heating value of coal	11,340 B.T.U. (as fired)
Combined efficiency	82.6%
Material cost for stoker maintenance	$922.93
Material cost per ton of coal burned	$ .0119

Characteristics of Coal

Moisture	8.5 to 11.5%
Ash	9.0 to 11.7%
Sulphur	2.9 to 3.98%
Fusion temp. ash	2076 to 2230° F.

427 Mile Freight Train!

It would require a freight train approximately 427 miles long (stretching from Cleveland, Ohio to Philadelphia, Pa.) to haul the 2,700,000 tons of coal required for the annual operation of Taylor Water-Cooled Stoker installations.

You Gain at Least 3 Ways

by using Taylor Water-Cooled Stokers:

1. Increased reliability.
2. Increased fuel flexibility.
3. Higher operating efficiency.

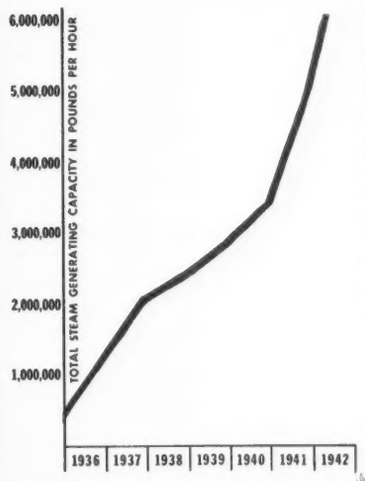
But there are many more advantages told in Catalog W which the coupon will bring to you. Mail this coupon.

TYPICAL EXPRESSIONS BY USERS OF TAYLOR WATER-COOLED STOKERS

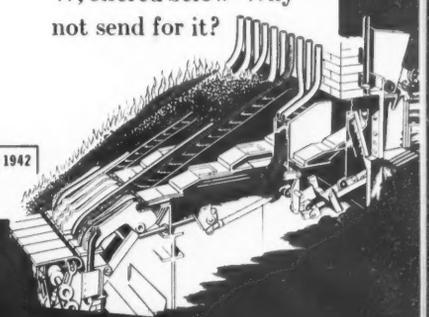
"OUR WATER-COOLED STOKER IS VERY RELIABLE AND FLEXIBLE WITH LOW MAINTENANCE AND HIGH AVAILABILITY WHILE BURNING A LOW GRADE OF FUEL THAT CANNOT BE BURNED SUCCESSFULLY ON AN AIR-COOLED STOKER."

"WATER-COOLED STOKERS VERY SATISFACTORY TO DATE. FUEL FLEXIBILITY ESPECIALLY GOOD. MAINTENANCE LOW."

Follow the Rise of Water-Cooled Stoker Sales



This chart tells you at a glance how power plant operators feel about the Taylor Water-CooledStokers. Many of the reasons for their enthusiasm are found in Catalog W, offered below Why not send for it?



A-E-CO TAYLOR WATER-COOLED STOKER

A-E-CO TAYLOR STOKER Water Cooled

AMERICAN ENGINEERING COMPANY
2400 Aramingo Avenue, Phila., Pa.

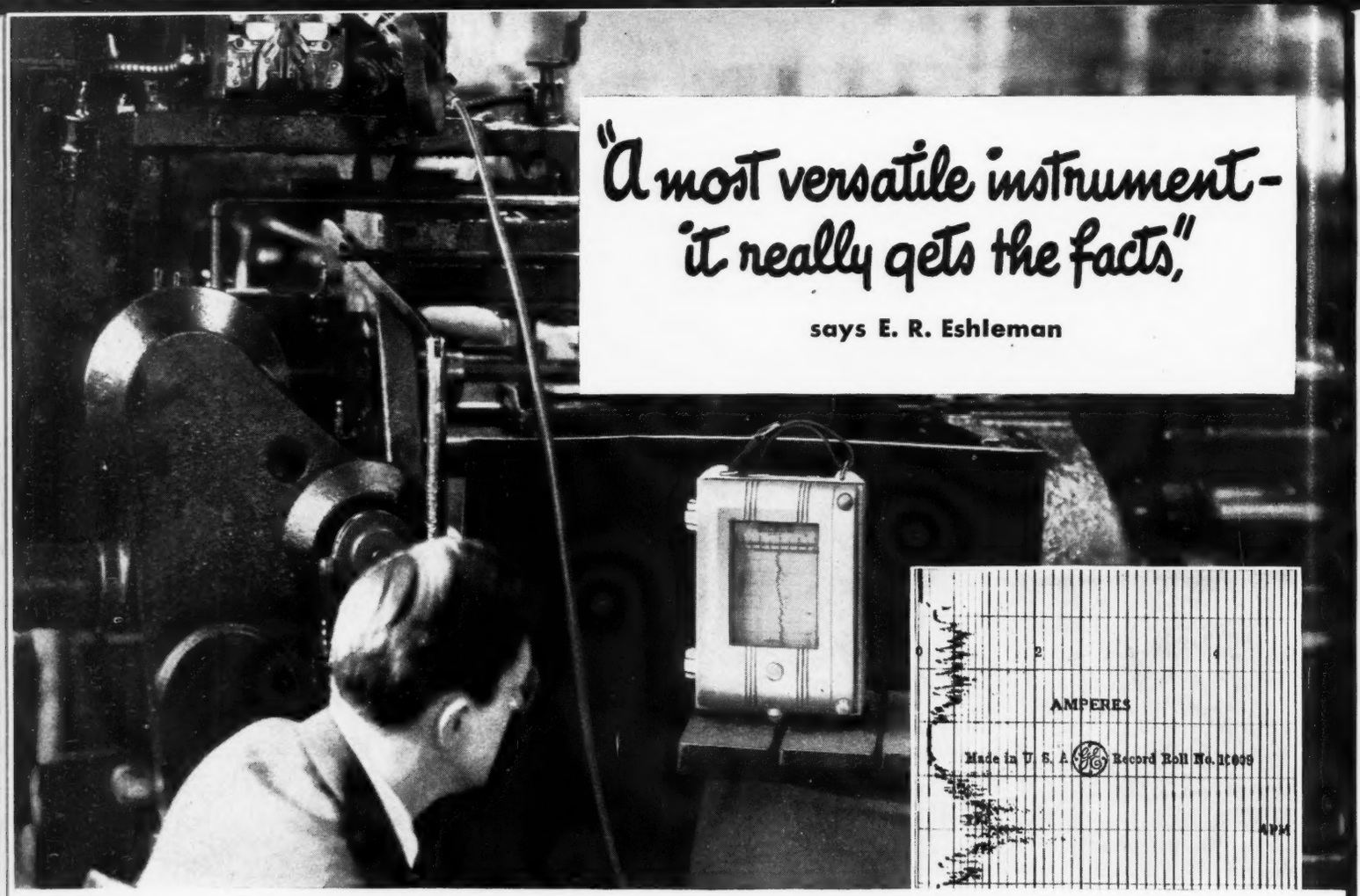
Send me without obligation a copy of the 8-page Catalog W describing Taylor Water-Cooled Stokers.

*Name*_____

*Company Name*_____

*Address*_____

*City*_____ *State*_____



"A most versatile instrument—it really gets the facts."

says E. R. Eshleman

Widely fluctuating load of a group of motors totaling 215 hp. You can easily pick out the current at any instant, and determine, at a glance, the duration of these currents.

G-E Recorders Help Him *GET THE JUMP* on Trouble

"WE have a complete line of switchboard and portable indicating instruments. But these were not adequate. We needed a recorder, and it had to be versatile, inexpensive, and easy to use. So, we selected a G-E inkless recording ammeter (and a split-core current transformer). It's the answer to our needs."

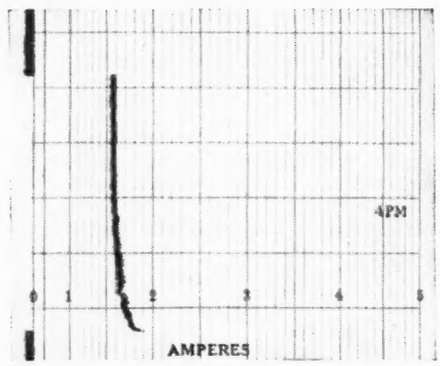
That's how Mr. Eshleman, Electric Motors Co., Lancaster, Pa., feels about this inkless recorder (Type CF-1).

Here's how he has been using it. The charts on the right show the records he has obtained of three important motor tests. When such records are available, it is easy to analyze plant conditions and make corrections before trouble occurs.

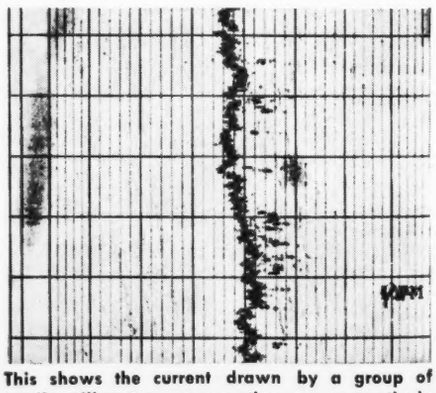
New Low Chart Speed Now Available

Furnished now with a one-inch-per-day chart speed—in addition to the speeds of 1, 2, and 3 inches per hour formerly available. This low speed puts a month's operation on a 30-inch chart. That greatly simplifies the work of analyzing surveys.

You can obtain both ammeters and voltmeters (in a wide range of ratings, a-c and d-c) with any of these chart speeds.



A record of a constant load on a ¾-hp motor. It indicates the definite running cycle, the current immediately after the starting period, and the load variation from the beginning to the end of the run.



This shows the current drawn by a group of textile-mill motors, representing a comparatively constant load with frequent starting periods.

Start Making Full Use of Recorders—Pick Yours from this Bulletin

General Electric, Sec. D602-37
Schenectady, N. Y.

Please send me your a-c and d-c recorder bulletin, GEA-3187.

NAME .....
COMPANY .....
ADDRESS .....
CITY ..... STATE .....

602-37-6200

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

"Take It From a Guy Who Knows Valves!"

● "Those axis guys still can't get it through their heads how come we can keep our plants rolling at top speed, even when it's impossible to buy new units or parts.

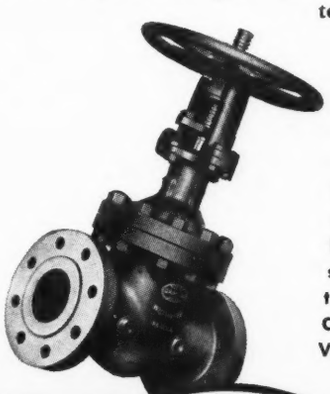
"But in America, we're like that. Ingenuity, I guess they call it. I call it smart buying *right in the beginning,* when the stuff is put in.

"Why, take this Darling Gate Valve here, for instance. It's been in this plant for 22 years, under the toughest kind of service and it's just as good now as the day it was put in. We've got plenty of other Darling Valves too, and all of 'em are just as good. That's what quality buying can do for you!

"Will they be going after the war is over? I'll say they will—and for a lot of years after that!"

Why not use the valve that for over 40 years has been setting records in a dozen industries for long life and low maintenance cost? In these days when replacements are harder and harder to get, it pays to buy for permanency—buy Darling.

●



Darling manufactures a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, you can get Darling Gate Valves in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

Only 4 PARTS

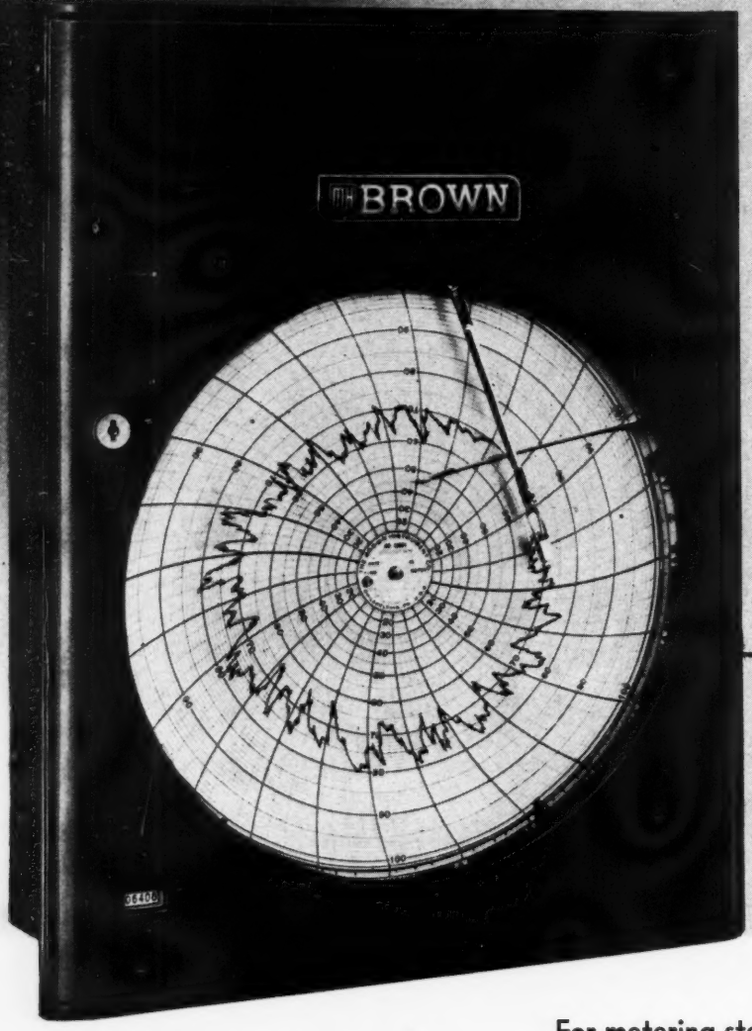
Two discs and two wedges—the entire working part assembly of a Darling Double Disc Gate Valve. There is no other valve with this design. The seats are parallel. The discs are *fully revolving,* seating in a different position each time the valve is operated. This means tighter seating, less wear, longer operation and lower maintenance costs with Darling Gate Valves.

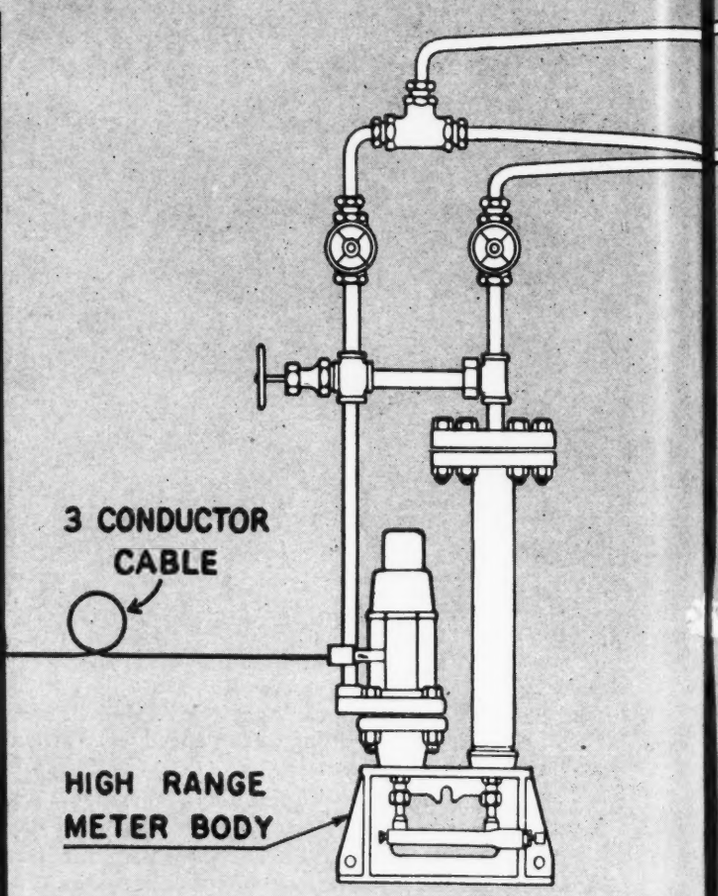
You don't have to take a Darling Double Disc Gate Valve out of the line to replace the parts. Simply insert new and inexpensive assembly parts and replace Stem and Bonnet. Valve is again ready for long, hard service.

TRADE DARLING MARK

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

Ideal for WIDE RANGE FLOW





HIGH RANGE METER

To Economize . . .

Measure and Record

STEAM Flow from each boiler.
STEAM Flow to auxiliaries.
STEAM Flow to individual units.
STEAM Flow from bleeders.
STEAM Flow to factory departments.
STEAM Flow to heating system.
STEAM Pressure on main header.
STEAM Pressure at feed water heater.
STEAM Pressure at all units.

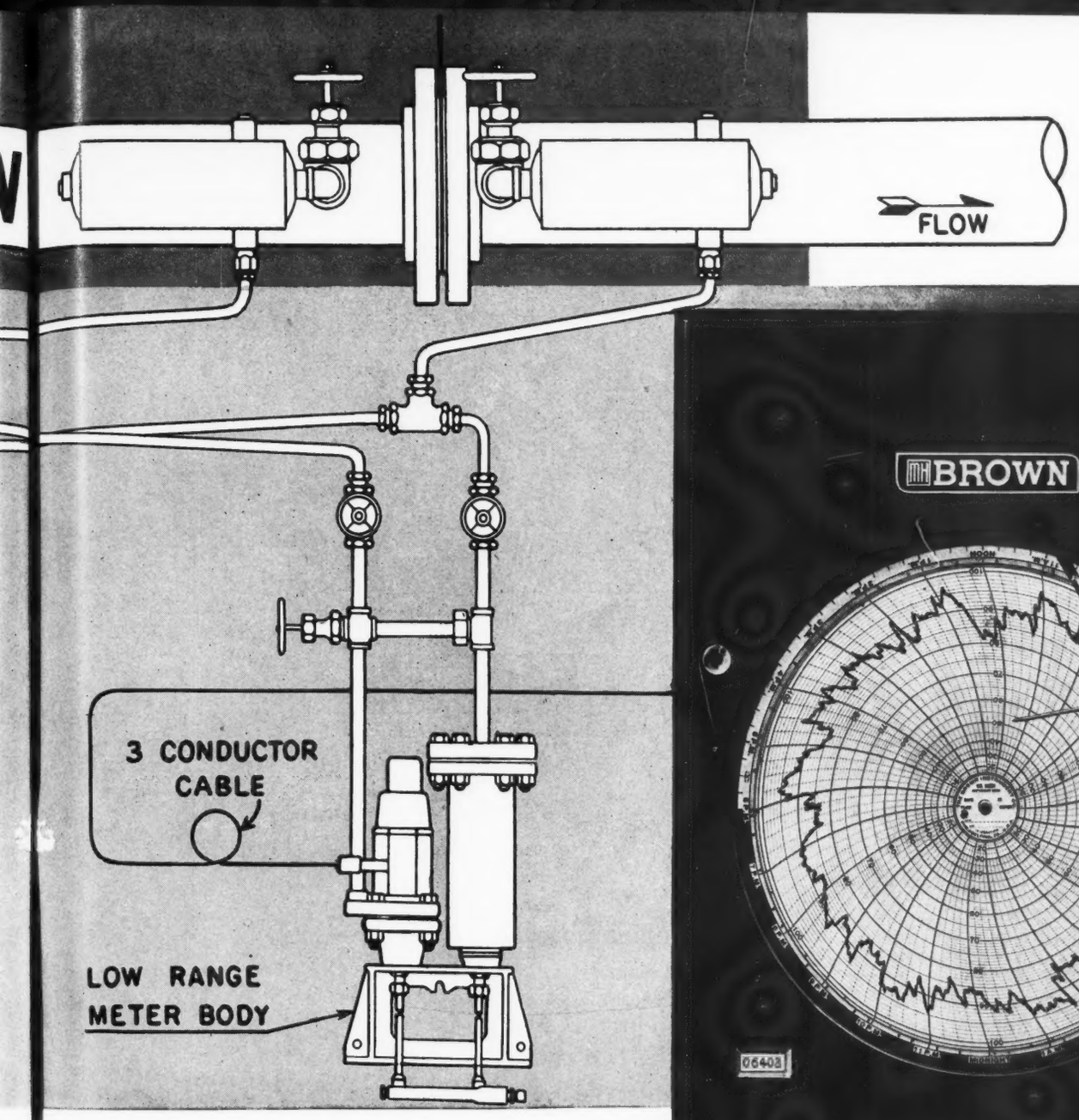
For metering steam where the flow varies over extremely wide ranges, the Brown Flow Meter System shown above, fulfills every requirement for high pressure steam heating and process loads.

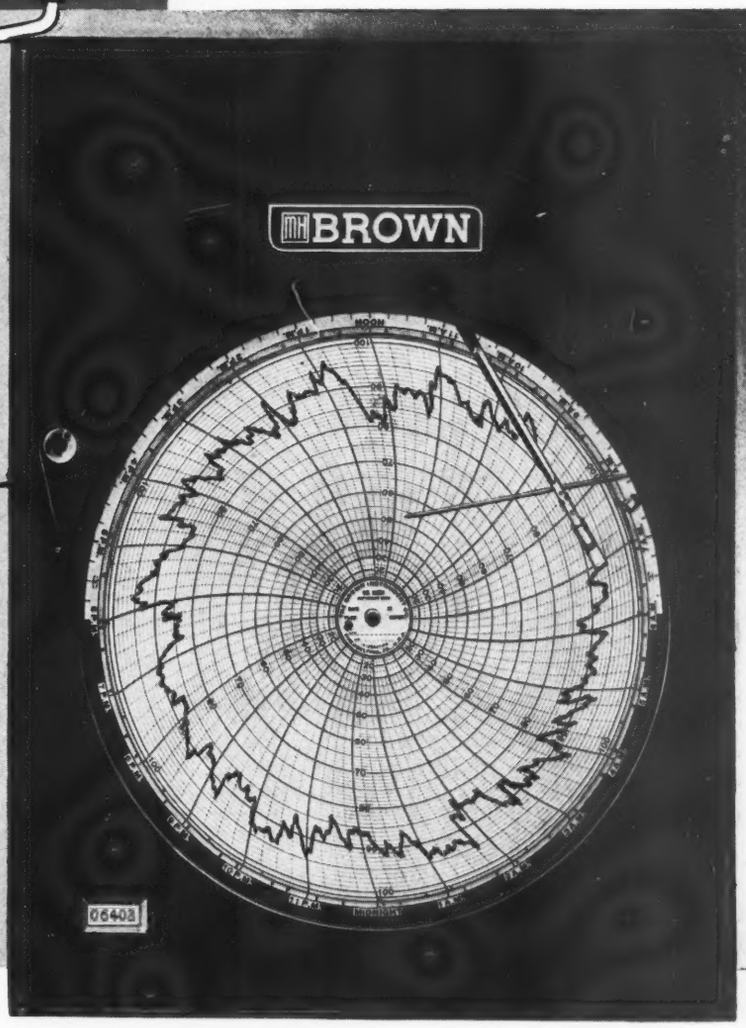
The system consists of two meters connected to the same orifice. The low range meter records and integrates the flow from 0 to 25 per cent of maximum.

The high range meter records and integrates flows from 25 per cent to 100 per cent of maximum. The sum of both integrator readings gives the total steam flow. The change from one meter to the other is automatic and requires no manual operation.

Either or both meters can be supplied with auxiliary indicating scales and can be equipped with air control features in case it is desired to limit the maximum flow.

BROWN





Brown Flow Meters are a guarantee of satisfaction to both the user and producer—for example, in the City of Washington, D.C., there are more than thirty stations where steam is measured by this practical method.

The Brown Wide Range Meter System is easily installed in large and small central distribution plants where accurate accounting is a requisite.

Write for Catalog No. 2007. THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4490 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter Street — England: Wadsworth Road, Perival, Middlesex — Stockholm, Sweden: Nybrokajen 7.

LOW RANGE METER

Operating Advantages

1. Operates on the Inductance Bridge Principle! Inherently independent of voltage changes.
2. AUTOMATIC PLANIMETER PEN gives you a record on total flows over any period of time.
3. SIX INTERCHANGEABLE RANGE TUBES assure quick adjustment to changes in operating conditions.
4. INTEGRATOR DIAL. Easy to read. Simple counter—plain figures. Read it like your automobile mileage indicator.

Flow Meters

NOTHING IS MORE IMPORTANT THAN ACCURATE

Diamond

BI-COLOR GAUGES

Make Reading CERTAIN

When you are forcing your boilers for every pound of steam they will produce . . . as you undoubtedly are today . . . accurate reading of water level becomes extremely important.

Diamond Bi-Color Water Gauges make reading absolutely accurate—with no difficulty at all.

By use of a simple, invariable optical principle—the gauge shows water as green and steam as red. The line where the two colors meet is the exact water level. It is easily and clearly recognizable . . . and the colors shift instantly with water level change.

The colors are so clear and brilliant the image can be reflected from drum to floor level—through as many as three levels of grating—with no confusion. The image, caught in the lower mirror, can be made a part of the boiler control panel.

Wherever steam power is produced in large quantities for war purposes—you are likely to find Diamond Soot Blowers, Diamond Bi-Color Gauges, and other Diamond Products.

DIAMOND POWER SPECIALTY CORP.
Detroit, Michigan
DIAMOND SPECIALTY LIMITED • Windsor, Ontario

WATER LEVEL READING IN HIGH PRESSURE BOILER OPERATION
RED IS STEAM
AN EMPTY GLASS IS ENTIRELY RED
GREEN IS WATER
A FULL GLASS IS ENTIRELY GREEN

ALL 6 REPORT *No*

*10 YEARS without a single stuck ring . . . 4 Diesels.

*"LESS WEAR, less carbon, no stuck rings" . . . 2 Diesels.

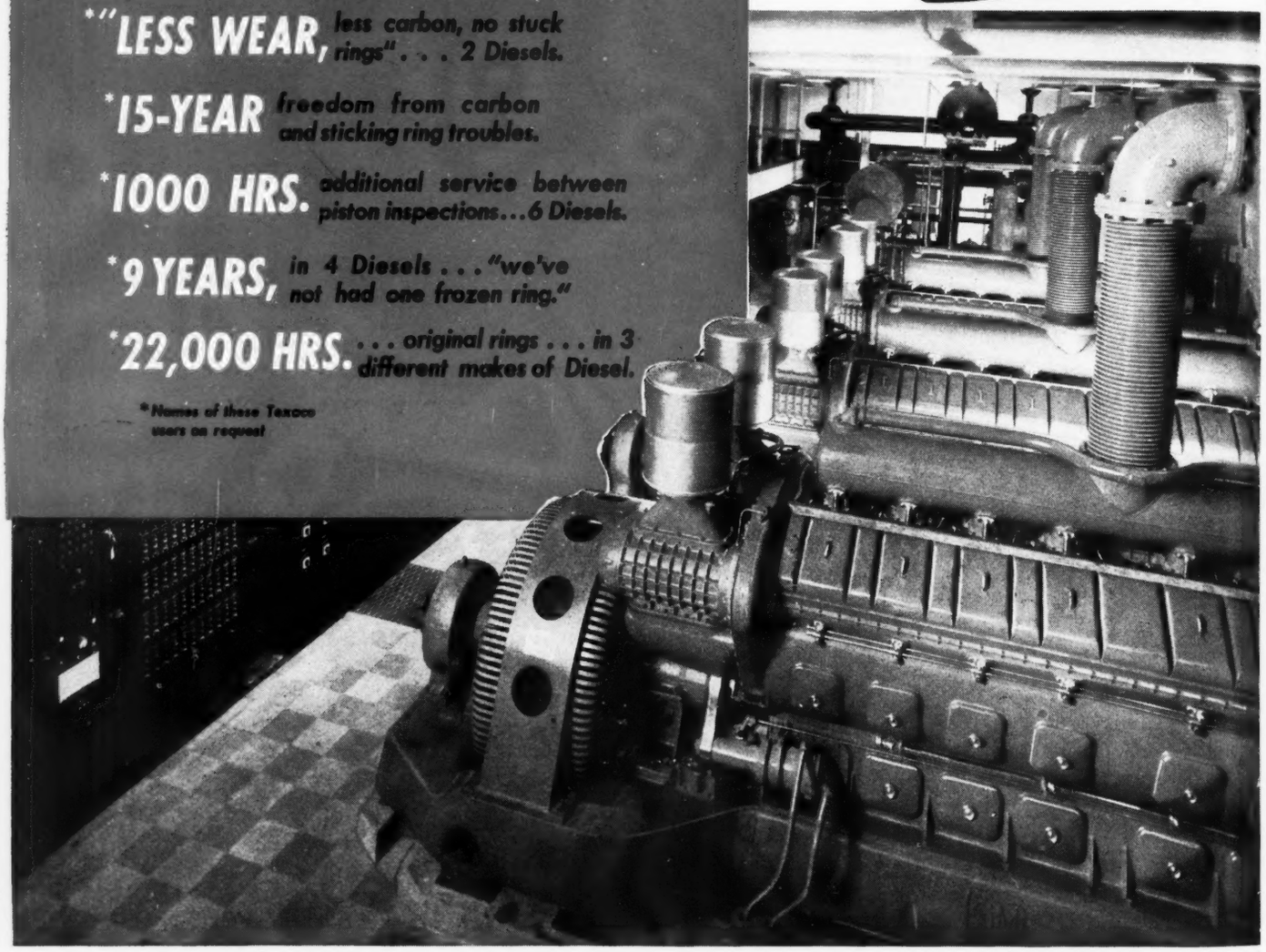
*15-YEAR freedom from carbon and sticking ring troubles.

*1000 HRS. additional service between piston inspections...6 Diesels.

*9 YEARS, in 4 Diesels . . . "we've not had one frozen ring."

*22,000 HRS. . . . original rings . . . in 3 different makes of Diesel.

*Names of these Texaco users on request



THREE 1050-HP. GENERAL MOTORS DIESELS in modern Miami office building. Freedom from stuck rings and very low oil consumption are attributed to the exclusive use of *Texaco Ursa Oil.*

TEXACO

REG. T. M.

TEXACO

Stuck Rings

IN your Diesels, too, rings will stay free . . . assuring fuel-saving compression and sustained, full-power output . . . when you use *Texaco Algol* or *Ursa Oils.*

Highly resistant to the formation of gum, sludge and carbon, these Texaco oils keep rings, ring grooves, valves and ports CLEAN. They reduce bearing and liner wear.

Because of the benefits Texaco brings—

More stationary Diesel horsepower in the U.S. is lubricated with Texaco than with any other brand.

The outstanding performance that has made Texaco *first* in the stationary Diesel field, has made it *first* in the fields listed in the panel.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States or write to:

The Texas Company, 135 East 42nd Street, New York, N. Y.

Care for your Car ..for your Country

THEY PREFER TEXACO

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

DIESEL OPERATION MANUAL. 96 pages of charts, diagrams, photographs and text, plus new section on special purpose Diesel lubricants and complete Diesel Lubrication Chart. Yours for the asking.

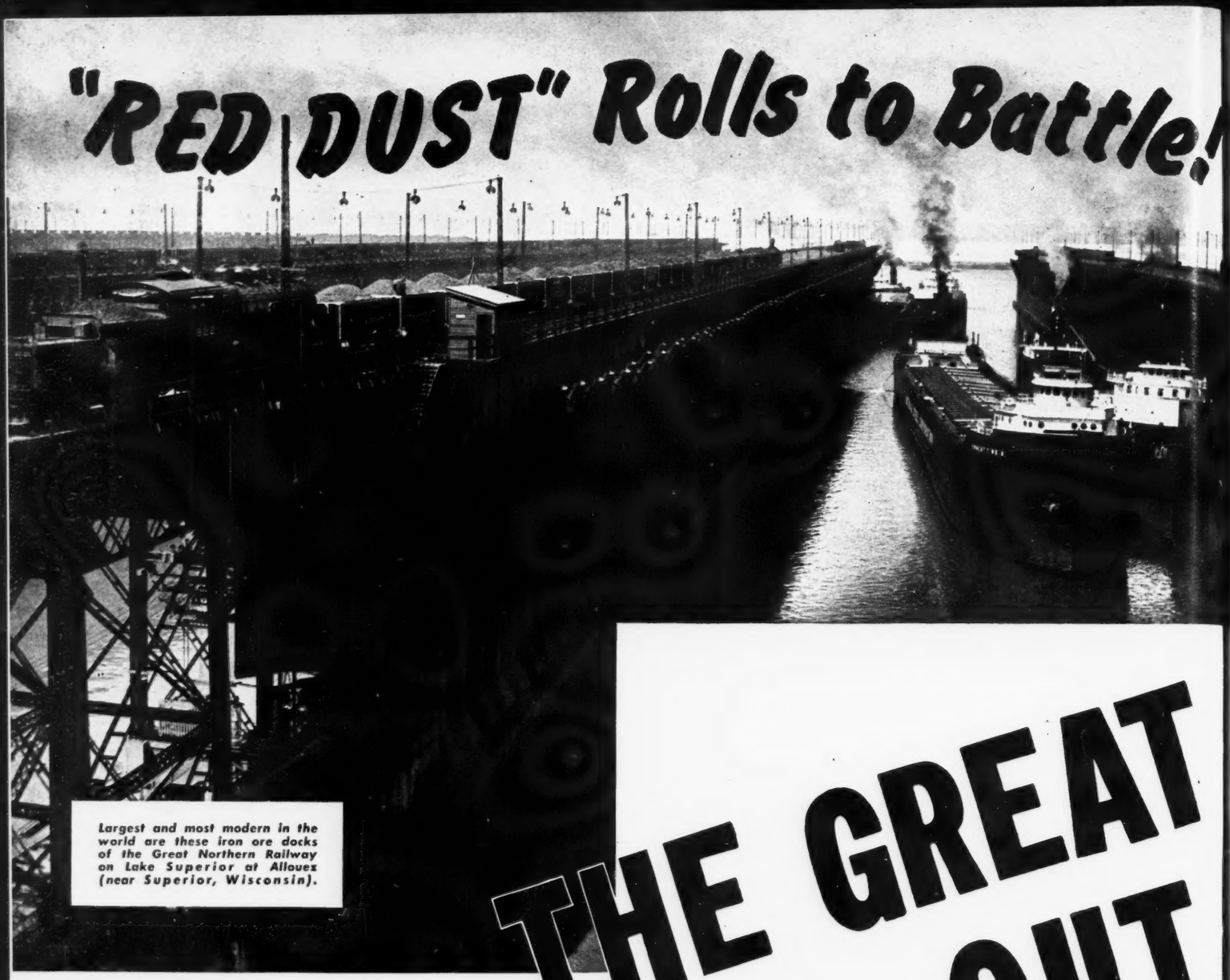
Tune in the TEXACO STAR THEATRE every Sunday night—CBS

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Lubricants and Fuels

FOR ALL DIESEL ENGINES

"RED DUST" Rolls to Battle!



Largest and most modern in the world are these iron ore docks of the Great Northern Railway on Lake Superior at Allouez (near Superior, Wisconsin).

THE GREAT ALL OUT

Cars of ore in the Great Northern's Allouez yards being thawed out (to facilitate handling) before the ore is docked and then dumped into the holds of freighters.

CLARAGE FANS Help Make Possible Record Breaking Iron Ore Shipments

Frozen ore *no longer* a headache!

Shipping usually closes around December 1st on Lake Superior. Yet weeks before that the nights are cold in northern Minnesota's iron country, and as the ore comes down by train from the mines its moisture content freezes — 75 tons per car a solid mass.

Try to move a mass like this quickly and efficiently from car to dock to freighter!

To meet the problem, to be able to ship maximum tonnage right up until the last boat leaves its Allouez ore docks (shown above), the Great Northern Railway in frosty

weather THAWS OUT the ore it handles.

Thawing out is done in the Allouez yards before the cars reach the dock for unloading.

How? . . . by means of steam which is generated in a new plant designed for that purpose — built and fully equipped in 45 days from a swamp to steam production.

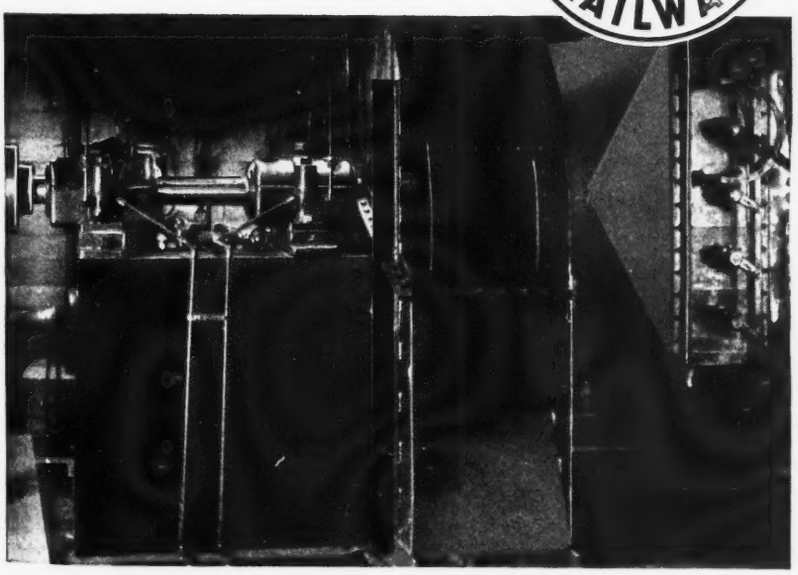
120,000 pounds of steam per hour is plant capacity — enough steam to thaw out 130,000 tons of frozen ore every 24 hours.

The Clarage Forced and Induced Draft Fans shown below meet draft requirements . . . another typical example of how Clarage helps those engaged in VITAL work go ALL OUT in America's war effort.

More iron ore for Pittsburgh and Gary means more tanks, guns and ships with which to lick the Axis — millions of tons more because of Great Northern's ingenuity! Clarage is proud to play a part in this notable Victory-assuring project.

NORTHERN GOES FOR WAR

GREAT NORTHERN RAILWAY



Above: One of 2 Clarage Type W Forced Draft Fans installed in the Great Northern Railway's new steam ore-thawing plant.

At Left: One of 2 Clarage Type RT Induced Draft Fans operating in this same plant.

Power failures are costly — especially costly if they interfere with the war effort! And sometimes fan shutdowns are responsible.

If you are engaged in work VITAL to the Nation's survival, and need fan equipment for draft or any other purpose, the Clarage story of *better* performance through *better* engineering and construction will interest you. Write or wire us today!

When you select Clarage Fan Equipment, you are *certain* of having draft apparatus which measures up to the most advanced ideas in power plant practice — fans equal to any service condition.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

CLARAGE FAN COMPANY KALAMAZOO, MICH.

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

HOW TO GET MORE SERVICE FROM PUMP RODS AND SHAFTS...

PART 1—

Re-conditioning by machining and re-finishing

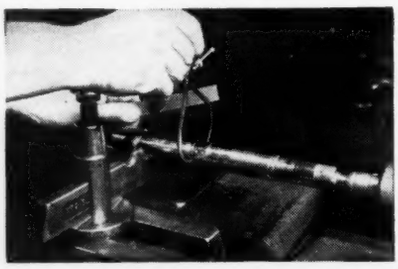
Worn pump rods, shafts and wearing sleeves are readily renewed by machining and refinishing, as described below. Usually, a light cut of less than 3/64 in. is sufficient to clean up the worn section.

However, one precaution must be observed: If too much metal must be removed the shaft may be unduly weakened. Therefore, if a shaft shows evidence of "whip" or a reciprocating pump rod tends to "bow" on pressure stroke, the pump manufacturer should be consulted. He will advise whether shaft needs building up before machining.

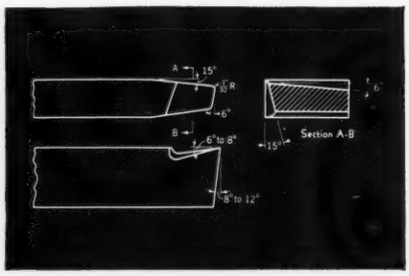
Methods for accomplishing the latter will be outlined in Part II of this subject.

Shafts and rods of Monel or "K" Monel can be reconditioned as described. Their high mechanical properties provide an extra margin of strength, rigidity, and toughness above the normal requirements of actual service.

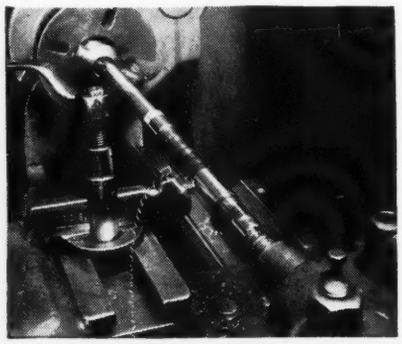
THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK, N. Y.



1. Set up shaft or rod rigidly between centers of engine lathe. Support with a steady-rest, if necessary, to prevent chatter. Measure diameter of worn section with calipers or a point micrometer to determine amount of metal to be removed.

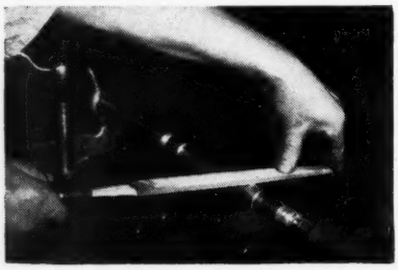


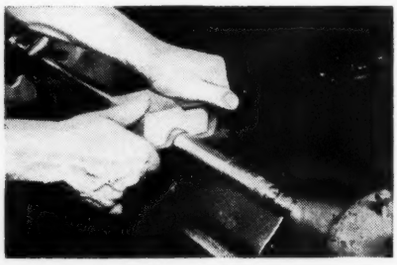
2. No special cutting tool needed — high speed tool preferable, but plain carbon steel satisfactory for this limited amount of machining. In machining Monel or "K" Monel tool should be ground as in sketch. Either a forged lathe tool, or a commercial tool bit (3/8-inch or 1/4-inch) may be used.



3. Take rough and finishing cut leaving enough metal for filing and lapping to final size. No lubricant needed, machining should be done dry. When refinishing rods, length of taper on steam end can be reduced to suit refinishing dimension, but original length of taper on the liquid end should be retained to support bronze pistons. For machining Monel, a speed of 55-60 ft. per min. with .005 in. feed can be used; for "K" Monel, a speed of 35 ft. per min. with .005 in. feed.

4. File machined surface with light pressure, using single cut, smooth file. File should be kept clean, "balled filings" avoided by chalking. A shaft or rod should be filed in direction in which it operates. A shaft should be filed as it revolves in the lathe; a reciprocating rod should be draw-filed lengthwise, turning shaft by hand as filing progresses.





5. Lap filed surface with No. 0 then No. 00 emery cloth. Shaft or rod should be lapped in the direction it operates. The cloth may be held with *half-round* wooden block. Only use emery cloth as long as a clean metal surface results. Cloth should not burnish.

6. *Before re-installing*

(*a*) Carefully clean finished surface to remove any particles of emery.

(*b*) Check need for new glands, bushings or followers, and larger size packing to fit smaller diameter of re-conditioned rod or shaft.

(*c*) Correct faulty condition or improper operation which may have caused original wear.

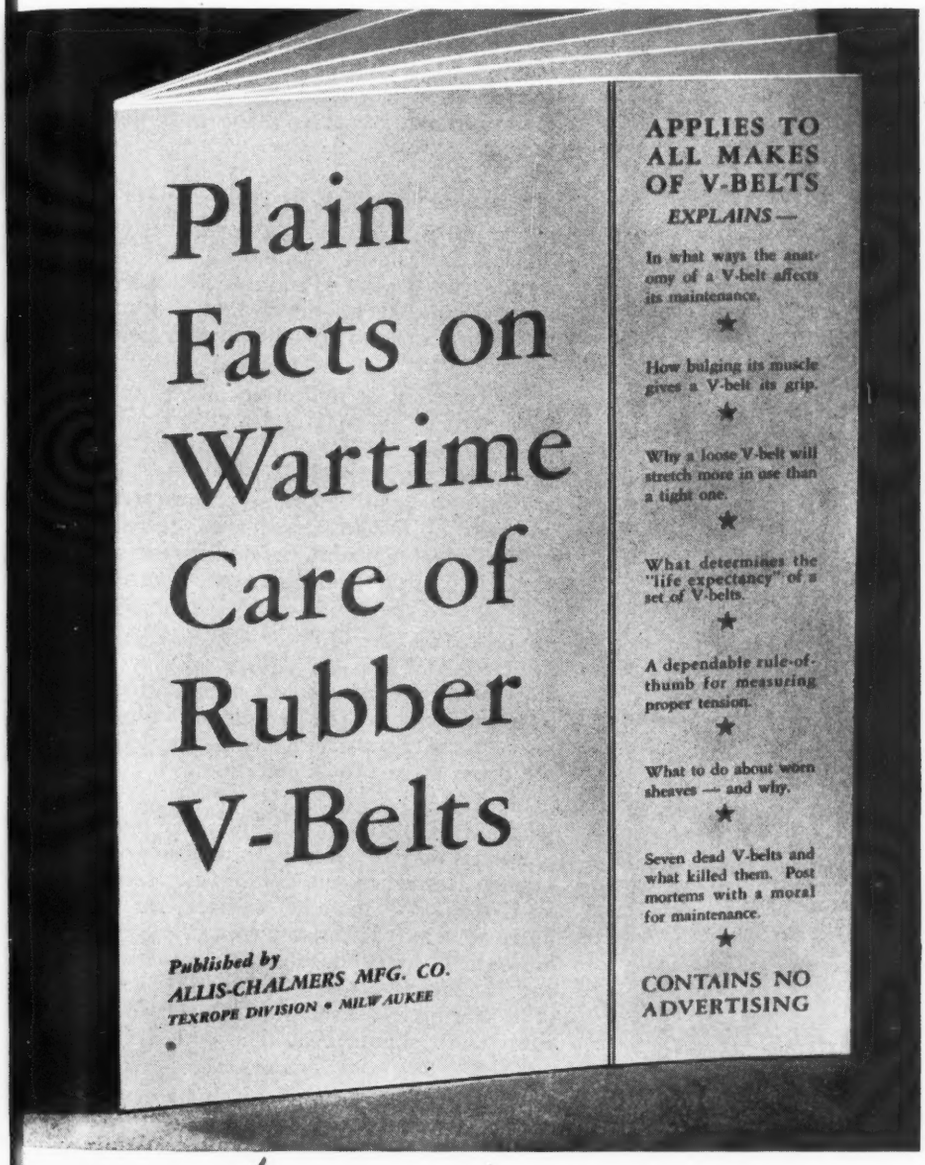
★ ★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★ ★

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL

Sheet... Strip... Rod... Tubing... Wire... Castings

ANNOUNCING ALLIS-CHALMERS' NEW

Wartime Guide to V-belt Care!


Plain Facts on Wartime Care of Rubber V-Belts
Published by ALLIS-CHALMERS MFG. CO. TEXROPE DIVISION • MILWAUKEE
APPLIES TO ALL MAKES OF V-BELTS
EXPLAINS—
In what ways the anatomy of a V-belt affects its maintenance.
How bulging its muscle gives a V-belt its grip.
Why a loose V-belt will stretch more in use than a tight one.
What determines the "life expectancy" of a set of V-belts.
A dependable rule-of-thumb for measuring proper tension.
What to do about worn sheaves — and why.
Seven dead V-belts and what killed them. Post mortems with a moral for maintenance.
CONTAINS NO ADVERTISING

It's free to every engineer, executive and maintenance man now concerned with raising V-belt performance to new wartime standards of efficiency. Rubber V-belts are a precious national asset! And here's the full, interesting story on how to make them work better, last longer than ever before. Send to Allis-Chalmers for this valuable new handbook today!

[PRINCIPLE OF THE V-BELT DRIVE]
Like Bending an Arm
...Bending a V-Belt
Bulges its Muscle!
HOW BULGING TENDENCY GIVES V-BELTS THEIR GRIP

FULLY ILLUSTRATED—It's packed with practical data...specially designed for training new men!

V-Day needs every V-Belt

FREE! Every engineer should have this important new handbook in his technical library. It applies to *all* makes of V-belts...contains no advertising. Tear out the order form and send it in *now!*

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive a *free* copy of "Plain Facts on Wartime Care of Rubber V-belts."

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ALLIS-CHALMERS

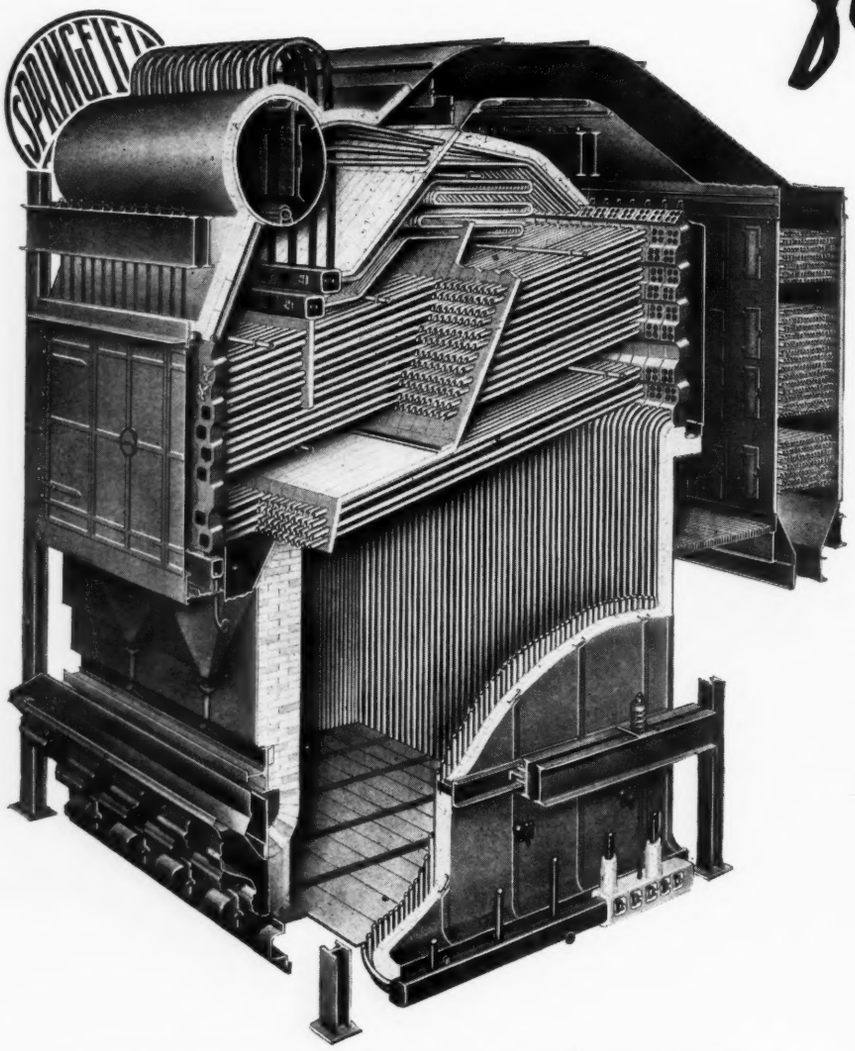
WE WORK FOR VICTORY — WE PLAN FOR PEACE

TEXROPE* SUPER-7 V-BELTS

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes.....½ h.p. to 2,000 h.p.

FEATURES THAT SAVE TIME!

30 to 60 Days Earlier Completion for War Plants



ACTUAL records on recent war plant boiler installations reveal that Springfield's design and method of fabrication and erection has cut from 30 to 60 days off the time commonly required for completion of the boiler installation. This important advantage is made possible by several factors.

★ **SHOP ASSEMBLED SECTIONS.** Sections of 3″ tubes rolled into rugged electric cast steel headers are assembled complete with baffles in our shop saving weeks or months in field construction time, depending on the size of the units. Water walls are also shop assembled where field conditions permit.

Each section is hydrostatically shop tested and inspected at pressure at least 50% over working pressure and never less than 500 lbs. Springfield's distinctive 4-tube grouping arrangement, combined with the sinuous headers gives each section rigidity and strength to withstand handling in shipping and in the field. Valuable time and labor savings, particularly on shipments going into overseas locations.

★ **COMPLETE 90% OF INSTALLATION BEFORE DRUM ARRIVES.** Delays in getting steel plates for drums is a minimum retardant on Springfield jobs. The setting can be put in, tubes, headers, water walls, auxiliaries installed—all before the drum arrives for connection.

★ **SINGLE DRUM.** A minimum amount of steel plate is diverted from shipbuilding and other urgent uses when the Springfield design is used. Cast steel, the material selected for turrets and hulls of newest Army tanks, has long been used by Springfield to produce better headers for boilers and water walls. With one size of straight boiler tube, Springfield averages about 1/16 fewer tube sizes than common bent tube boilers.

★ **DELIVERY.** Springfield shops are not loaded up with mass production of standardized boilers. Immediate attention can be given to units to meet the most special needs. Write, phone or wire for quotations. SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill.

DUPLICATE UNITS

COMPLETE drawings, patterns, shop fixtures, etc., are on hand to duplicate any of the many modern Springfield steam generating units built in recent years. Capacities from 5,000 lbs. to 450,000 lbs. per hour, or more. Pressures from 75 lbs. to 750 lbs., or higher. Springfield regularly takes contracts for complete steam generating units.

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

By the Hundreds

AMERICA'S LARGEST PLANTS

ADOPT G.T.M. INDUSTRIAL RUBBER CONSERVATION PLAN

Key executives acclaim Goodyear-developed procedure that can prolong life of rubber products as much as 50%. Get your plant started now. No charge.

With this 40-page manual, "Goodyear Industrial Rubber Products Conservation," your men have complete instructions for salvaging rubber products. It's furnished free—to designated operating men.

IN a few short weeks the Goodyear Rubber Products Conservation Plan has become American industry's first line of defense against the rubber shortage.

More than a thousand top operating men from major manufacturing companies have enthusiastically endorsed the plan, at meetings held, in fifty cities from coast to coast, by the G. T. M.—Goodyear Technical Man.

So impressed have they been by its rubber-saving possibilities, many asked the G.T.M. to come into their plants and explain the program in detail to the mechanical staffs. Upwards of 200 of these individual plant meetings have now been held, and many more are scheduled.

That is the verdict of industry on the Goodyear plan — a practical program for conserving your now almost irreplaceable rubber products and prolonging their life many extra months.

AVAILABLE TO ALL

The Goodyear conservation program consists of three simple, easy-to-follow steps;

"Goodyear Wages War on Waste"—a graphic, educational slide film which illustrates to your men, plainly and clearly, recommended conservation practices.

Practical plant demonstrations by the G.T.M. —what to look for, how to inspect and what measures to take to give hose, belts and other products longer life.

"Goodyear Industrial Rubber Products Conservation" manual—a fully illustrated 40-page book, telling exactly how to make repairs, and filled with suggestions for saving rubber — left with your operating men for their guidance.

HOW TO GET THE PROGRAM

To have the G.T.M. hold a rubber conservation meeting at your plant, simply write us today, and a definite date will be set. There is no charge for this service; it is not necessary that you be a Goodyear customer — it is all part of Goodyear's effort to help the nation save rubber. To arrange for your meeting, or obtain copy of the manual, write: Goodyear, Industrial Conservation Dept. E-12, Akron, Ohio.

THE GREATEST NAME IN RUBBER

GOODYEAR
MECHANICAL GOODS

. . . . THEY ENDED AL

LUBRICATION NIGHTMARE

when they switched to

TYCOL STEAM CYLINDER OIL

In the words of one operator, "For the past six years we have been using Tide Water Cylinder Oil. During the entire period we have had no trouble of any kind with the engine. The troubles that once kept us on the run were eliminated six years ago." Another operator had this to say, "The trouble we had been having with our steam engine cleared up immediately when we changed to Tycol oils. Besides giving us better lubrication the lower consumption actually saved us 33⅓% of oil costs."

These men, like many others, have ended what were literally lubrication nightmares. Tycol Steam Cylinder Oil cured these troubles. This modern lubricant is made from 100% Pennsylvania crude. Its maximum chemical and physical stability, and flat temperature viscosity curve assure effective lubrication and sealing films with resulting economies.

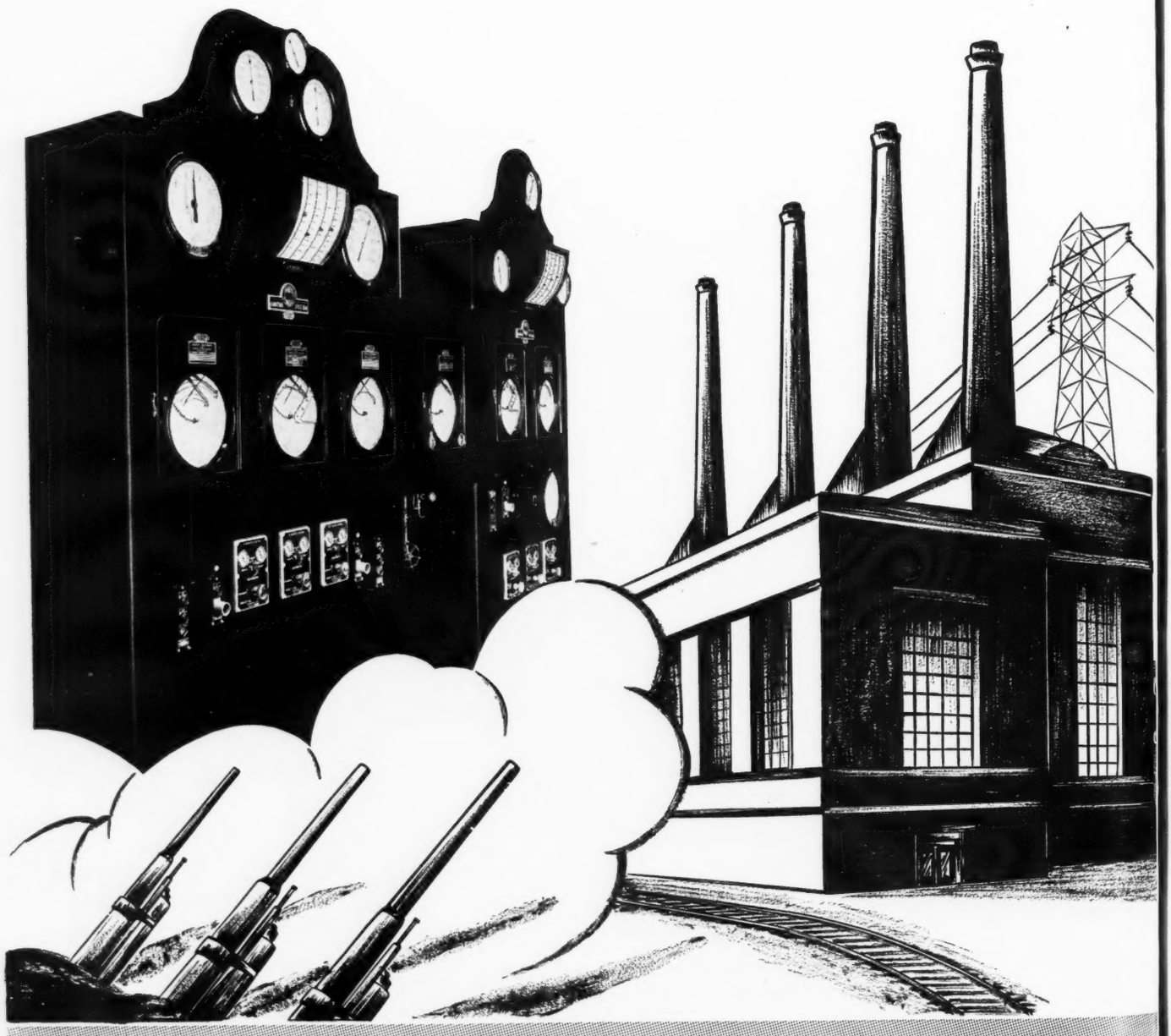
Efficient lubrication assures untroubled engine performance for today's heavy production needs. If you're plagued by lubrication worries call in a Tide Water engineer. He will recommend the proper Tide Water lubricant "engineered to fit the job." Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

TIDE WATER ASSOCIATED OIL COMPANY
EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

ARMS FOR THE BATTLE



BAILEY METER CONTROL . . .

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

OF PRODUCTION

★ This is a mechanized war. Battles are being won by hard-fighting men who are well armed with modern equipment.

In the battle of production the boiler operator whose effectiveness is multiplied by Bailey Meters and Control is like the machine gunner who rides to battle in a jeep, tank or airplane. Both men are better able to serve because they use modern arms.

To win the battle of production, boilers must be kept in almost continuous service, maximum capacities must be secured, fuel must be conserved, men and equipment must be protected against accidents, and new manpower must be trained.

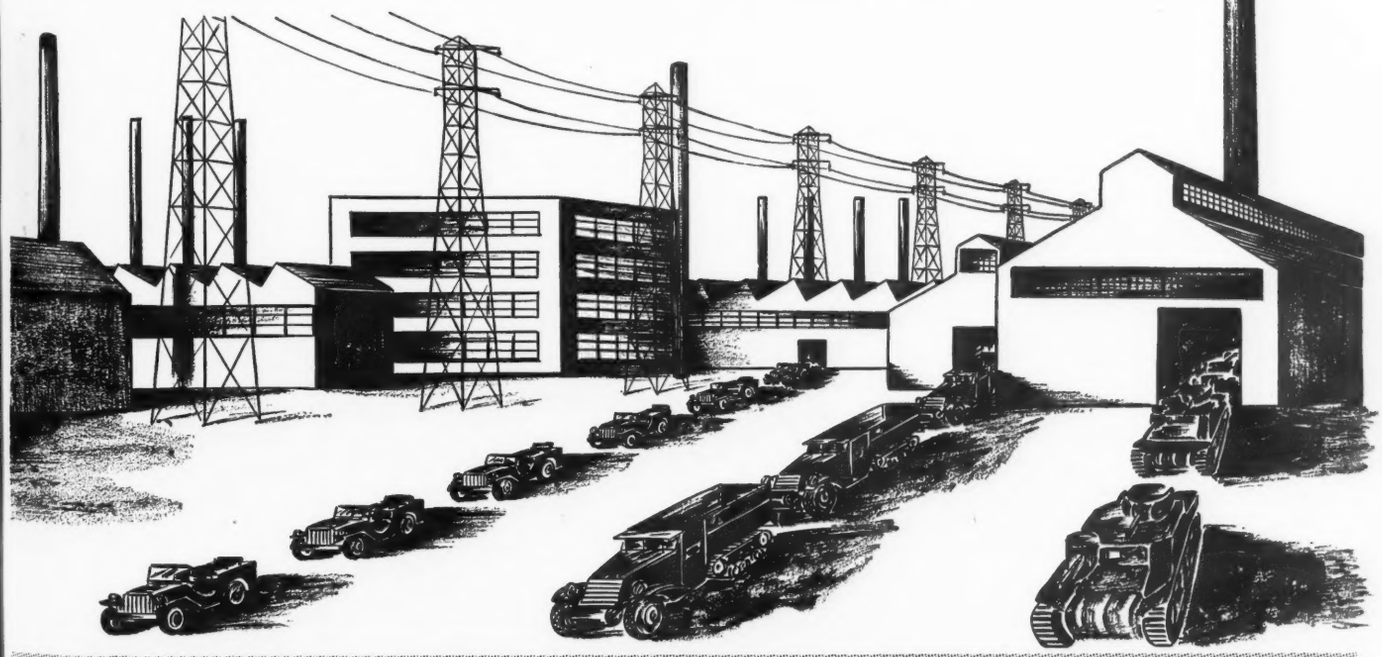
Bailey Meters and Control are helping to win this battle. They are modern arms for boiler room soldiers. By their use power engineers are able to:

1. Avoid frequent shutdowns for maintenance.
2. Stretch steaming capacity.
3. Reduce consumption of fuel.
4. Insure safety of men and equipment.
5. Maintain efficiency while training new operators.

Their use is explained in the bulletin "How to Safely Stretch Steaming Capacity", which offers suggestions for the solution of many of today's problems. To obtain a copy simply ask for Bulletin No. 16.

A-84

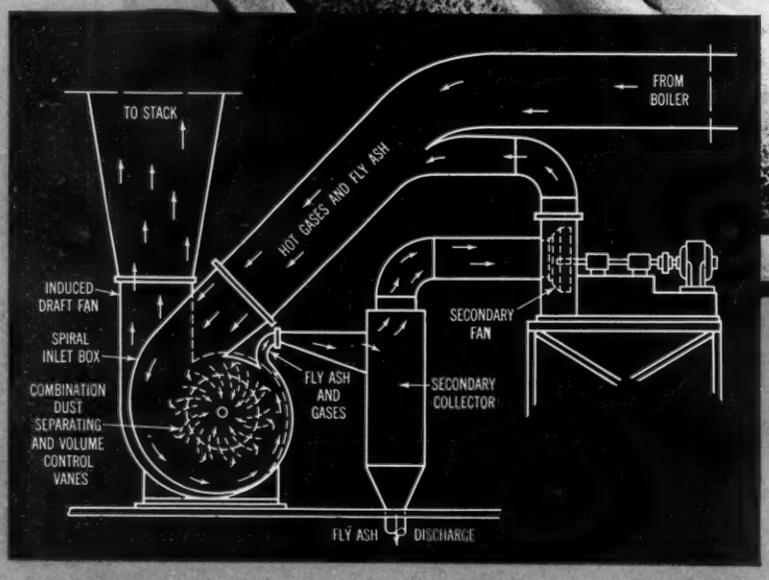
BAILEY METER COMPANY
1036 IVANHOE RD. • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada



The Complete Combustion Control System

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

FLY ASH IS



UNIQUE STURTEVANT "REVERSE-FLOW"

The Diagram at left and illustration above show the principle used to collect fly ash in the S.A.I.D. system, while preventing the ash from contact with the fan wheel. The portion of the gases carrying the concentrated dust is removed from the inlet boxes and carried to a collector for disposal—the clean gases being returned to the system.

"SIDE TRACKED"

BEFORE IT HITS THE WHEEL

ABRASION of induced-draft fan wheels by fly ash has become an increasingly urgent problem under today's extremely high capacity ratings. Given really severe ash and load conditions, the life of an unprotected induced draft fan wheel may be measured in terms of WEEKS! Yet to obtain necessary materials for replacement of worn-out equipment may take MONTHS.

Sturtevant meets this situation with a *combination* Induced-Draft Fan and Dust Collector System that sidetracks fly ash *before* it hits the wheel. Developed out of the years of research by engineers working in Sturtevant's Dust Control Laboratory and in the field, this combination unit embodies a unique "reverse-flow" design which utilizes the weight of the flying ash particles to separate them from the flue gases. Even in cases where a majority of the fly ash present will pass through a 325 mesh screen this S.A.I.D. system removes a high percentage of the "fines".

Sturtevant can help you solve your fly-ash or other dust-collecting problem. The Sturtevant combination induced-draft fan and dust collector is only one of many developments made possible by exhaustive research in Sturtevant's Dust Control Laboratory. The same knowledge and experience that produced this new unit is yours to command in the fight against destructive dust – everywhere that it menaces war production.

B. F. STURTEVANT CO., HYDE PARK, BOSTON, MASS.

Branch offices in 40 other cities

B. F. Sturtevant Co. of Canada Limited—Galt, Toronto, Montreal

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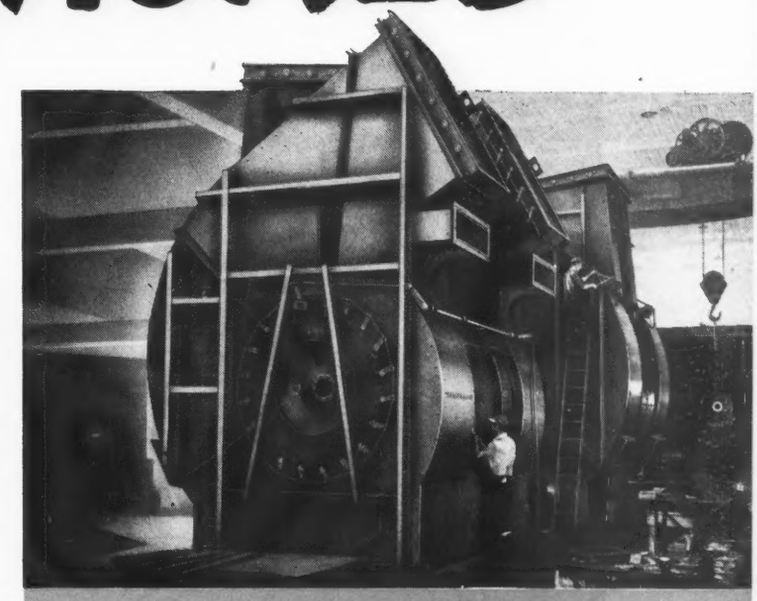
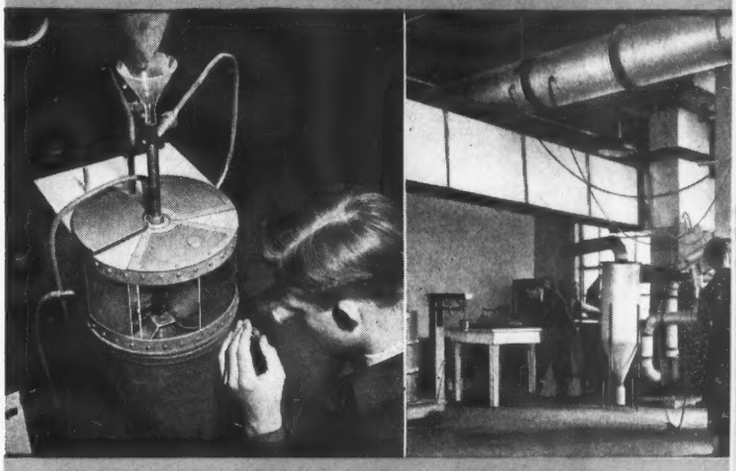
Sturtevant

REG. U. S. PAT. OFF.

Puts Air to Work



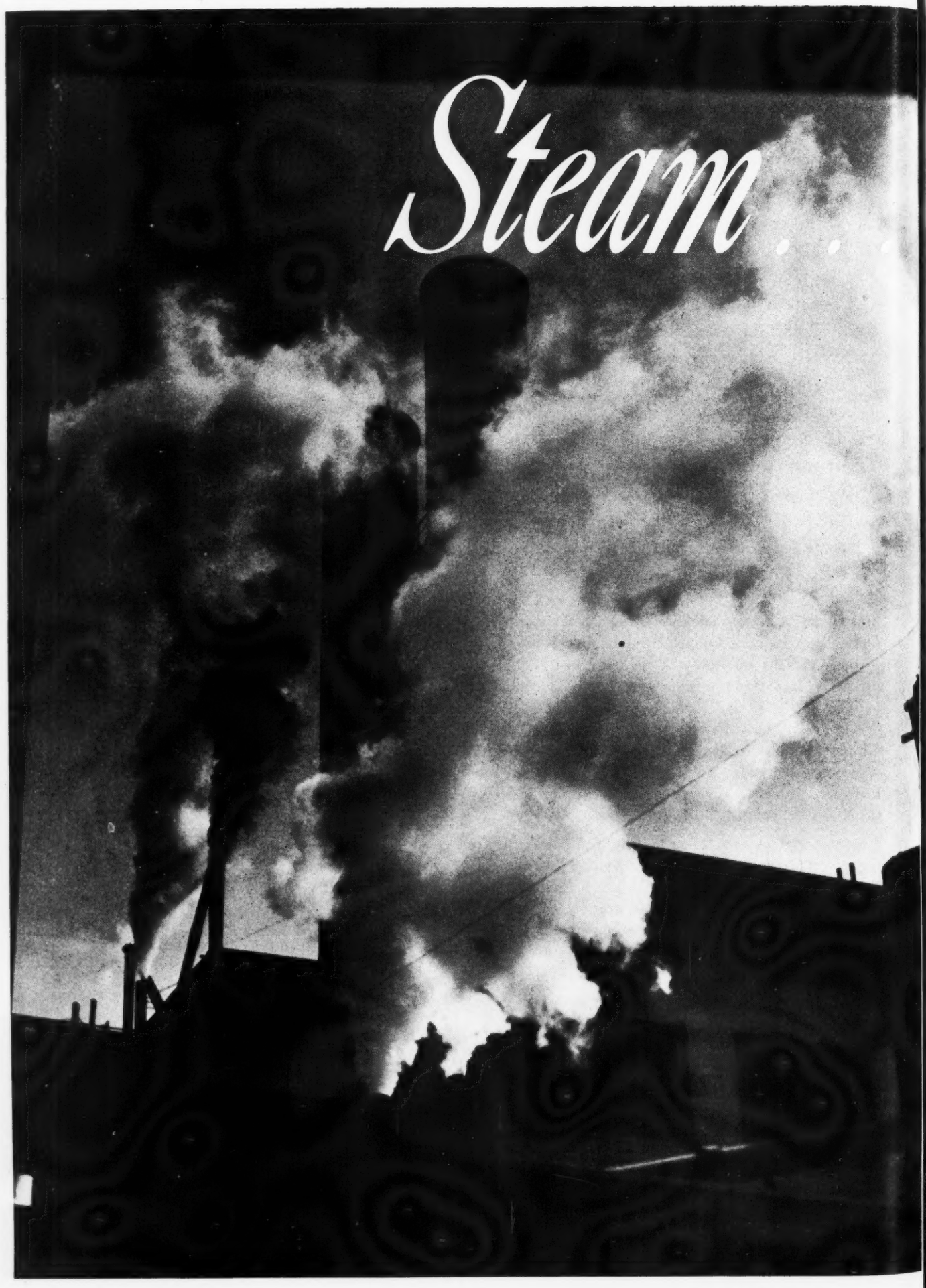
STURTEVANT S.A.I.D. FAN—Shop view of giant S.A.I.D. Fan ready to "Join the service" producing vital power. After a *year* of heavy duty service by this fan, practically no sign of wear was visible when inspected. The built-in Dust Collecting System proved so effective the life of the fan has been materially extended.



TRACKING DOWN THE "CRIMINALS" that cut ordinary fan wheel life to weeks . . . Size and nature of dust particles, size of collector, air velocity—all of these factors must be studied in solving dust-collecting problems. In the views above, Sturtevant technicians are seen using some of the unique equipment in the Dust Control Laboratory.

FIELD TEST—Sturtevant Engineers gather flue-dust samples to determine the quantity as well as the characteristics of fly ash.

DRAFT FANS • TURBINES • GEARS • ECONOMIZERS • AIR HEATERS


Steam . . .

the lifeblood of America's War Effort

Here is how Hagan can help you <u>at once</u> to obtain maximum steam output

OF all the advantages that Hagan Automatic Combustion Control offers you . . . increased efficiency, constant steam pressure, proper distribution of load among boilers . . . none is so important to you today as the fact that it assures you of *maximum steam output per pound of fuel.*

Regardless of other means of increasing boiler capacity, Hagan Control, of itself, will *increase steam output directly* by giving you:

MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM UTILIZATION value, uniform steam pressure and temperature, in accordance with demand.

MAXIMUM OUTPUT from boilers of differing capacities, automatically.

MAXIMUM STEAM for production, by reducing loss of steam in frequent soot-blowing.

MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

The plant prepared for maximum efficiency today is the plant prepared for maximum economy tomorrow. Write or wire today for a Hagan engineer. He'll come at once.

HAGAN CORPORATION
HAGAN BUILDING
PITTSBURGH, PA.

SPECIFIC ADVANTAGES OF HAGAN AUTOMATIC COMBUSTION CONTROL

Simplicity of operation.
Ease of installation.
Ruggedness of equipment.
Sensitivity to small load changes.
Accuracy of adjustments for small variations.
Speed of movement, with stability, throughout operating range.
Flexibility in meeting individual plant conditions.
Engineered by the pioneers and leaders in automatic combustion control.

HAGAN *Automatic* COMBUSTION CONTROL
The pioneer . . . and still the leader

3 QUESTIONS

1. Who offers the most complete line of stokers?

2. Who has built more than 17,000* stokers?

3. Who has installed enough stoker capacity to serve 5,000,000 rated boiler hp?

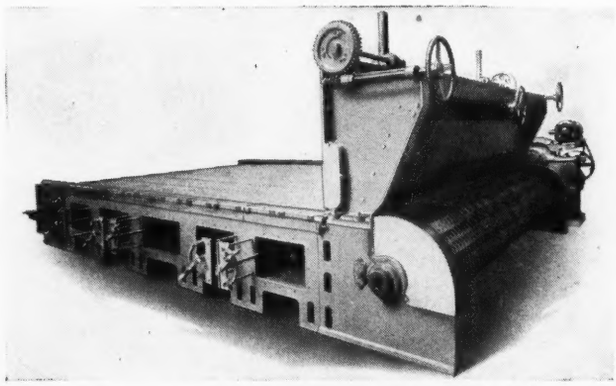
*Above residence size.

These facts that unmistakably establish C-E as "headquarters" for stokers are more than a mere statement of leadership in the field. They also assure two benefits which are gained by those companies which entrust their stoker needs to C-E.

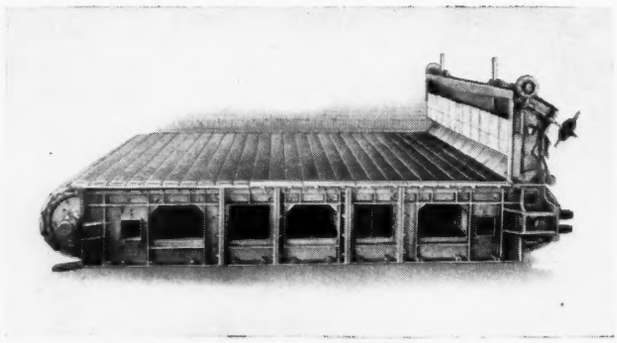
1st—*The complete line* removes any bias in favor of any particular types of stokers. It enables C-E to recommend the stoker installation which experience has established as the most suitable for your requirements of capacity, load conditions and type of available fuel.

2nd—*The vast experience* gained through building more than 17,000* stokers of all types—ranging in size from 7 to 672 sq ft of grate surface—qualifies C-E to help you determine the best stoker for your purpose and also offers assurance of proper construction and competent installation.

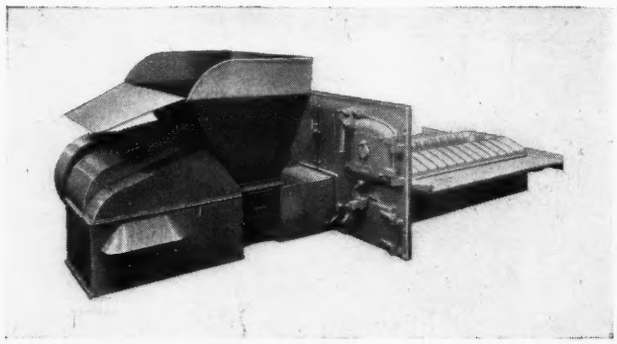
This combination of qualities..variety of stoker types and extensive experience in their application.. has won customer-confidence because it promises the greatest satisfaction in terms of efficiency, dependability and low maintenance.



C-E Chain Grate Stoker. Particularly well-suited to the use of free-burning bituminous coals. Approximate application range is from 150 rated boiler hp up to units producing 275,000 lb of steam or more per hr. Built in both forced-draft and natural-draft designs.



C-E Traveling Grate Stoker. Unequalled for burning the small sizes of anthracite and coke breeze; also well suited to lignite and some free-burning bituminous coals. Approximate application range is from 150 rated boiler hp up to units producing 200,000 lb or more of steam per hr.



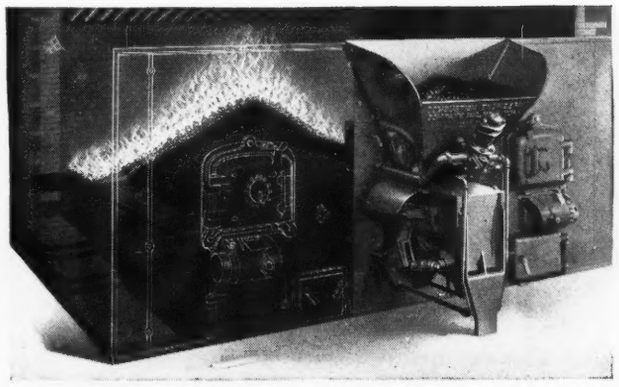
C-E Skelly Stoker. A single-retort, underfeed stoker available in designs for burning either anthracite or bituminous coal. Applicable to boilers ranging from 20 to 200 rated boiler hp. Equipped with either electric or steam drive.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS, AND AIR HEATERS

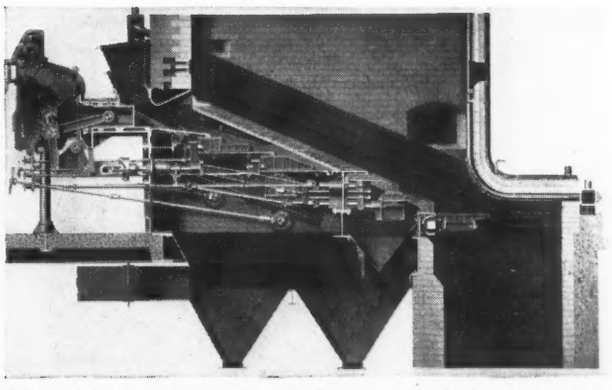
COMBUSTION

1 ANSWER

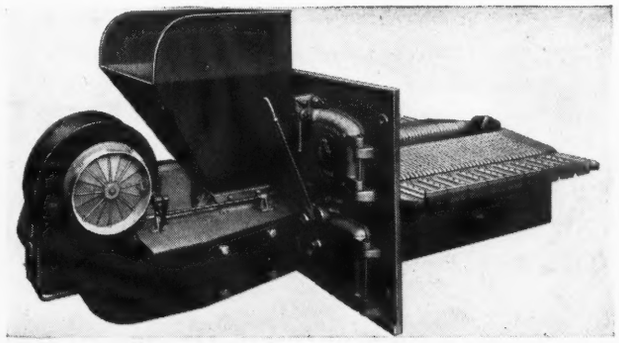
COMBUSTION ENGINEERING



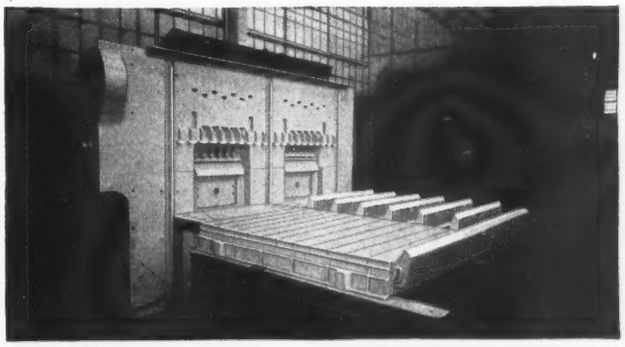
C-E Type E Stoker. A single-retort, underfeed stoker designed to burn either coking or non-coking bituminous coals. Applicable to boilers ranging from 150 to 600 rated boiler hp. Equipped with integral steam piston, electric or hydraulic drive.



C-E Multiple Retort Stoker. A multiple retort underfeed stoker designed to burn either coking or non-coking bituminous coal. Approximate application range is from 500 rated boiler hp up to the largest units for which stoker firing is suitable. Equipped with steam dump, clinker grinder or continuous discharge ash trays.



C-E Low Ram Stoker. A ram type, underfeed stoker designed to burn either coking or non-coking bituminous coal. Applicable to boilers ranging from 35 to 200 rated boiler hp, especially where head room and furnace volume are limited.



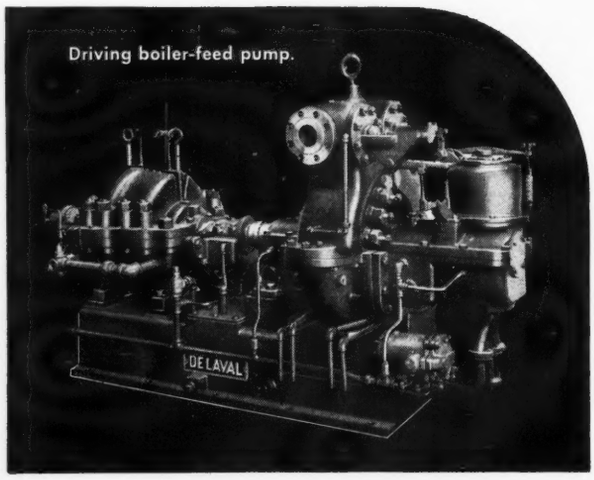
C-E Spreader Stoker. A simple, rugged stoker designed to burn an unusually wide variety of coals. Approximate application range is from 150 rated boiler hp up to the largest units for which stoker firing is suitable.

A-880

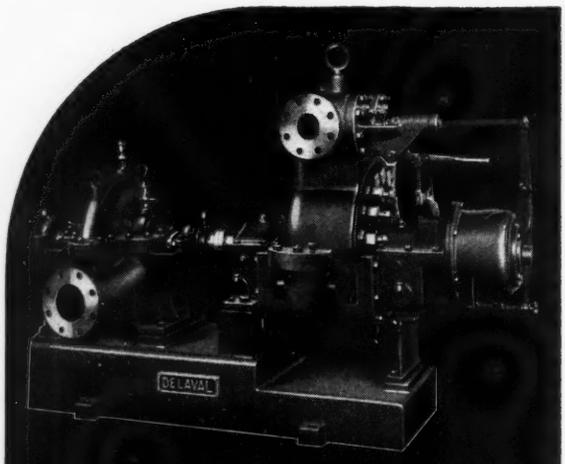
COMBUSTION ENGINEERING COMPANY, INC., 200 MADISON AVENUE, NEW YORK, N. Y. CANADA: COMBUSTION ENGINEERING CORPORATION, LTD., MONTREAL

ENGINEERING

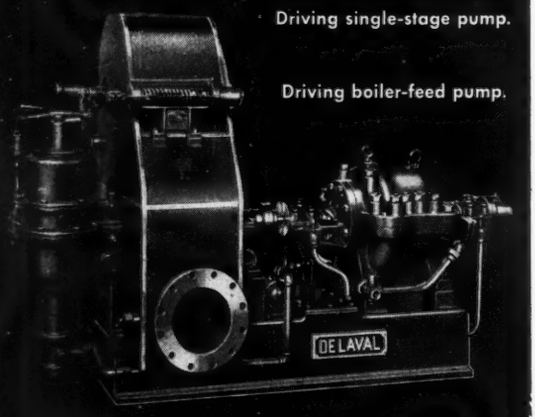
10 Advantages of DE LAVAL Velocity-stage TURBINES for Driving Auxiliaries



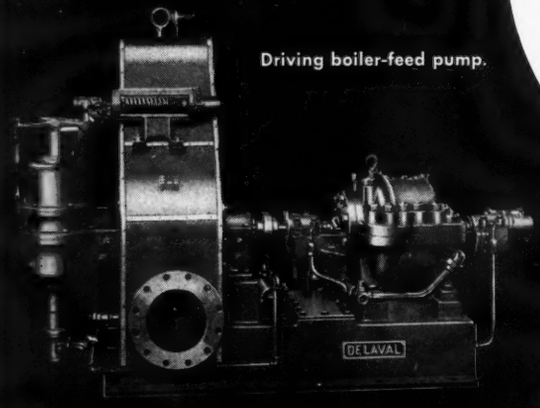
Driving boiler-feed pump.



Driving single-stage pump.



Driving boiler-feed pump.



Driving boiler-feed pump.

1 Most reliable; independent of electrical transmission line, generator and switchboard disturbances.

2 Create no fire hazard; cannot short circuit; sparkless.

3 Immune to hot or moist atmosphere.

4 Low maintenance and attendance costs.

5 Take the place of reducing valves.

6 Produce practically costless by-product power from heating or process steam.

7 Maintain heat balance with varying power and heat loads, avoiding waste of steam and unnecessary charges for electrical current.

8 Exhaust free of oil or grease.

9 Inexpensive as stand-by drives, always available while there is steam pressure.

10 Speed can be adjusted over a wide range, while still maintaining good efficiency.

Our engineers will supply information and advice upon receipt of data as to steam and power conditions in your plant. *ASK FOR PUBLICATION T-3528.*

DE LAVAL *Steam Turbine Co.*

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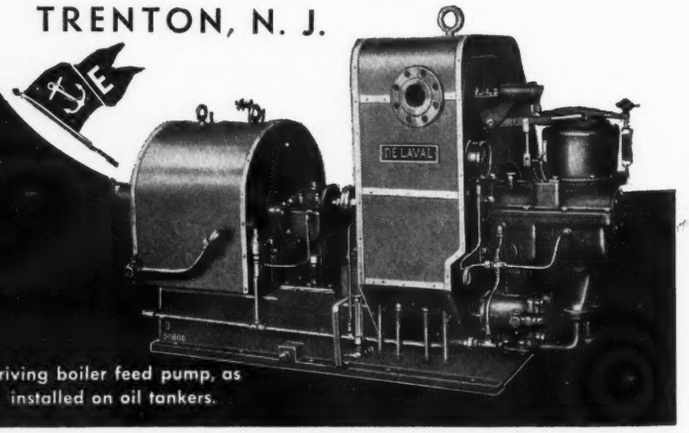

Driving boiler feed pump, as installed on oil tankers.

POWER

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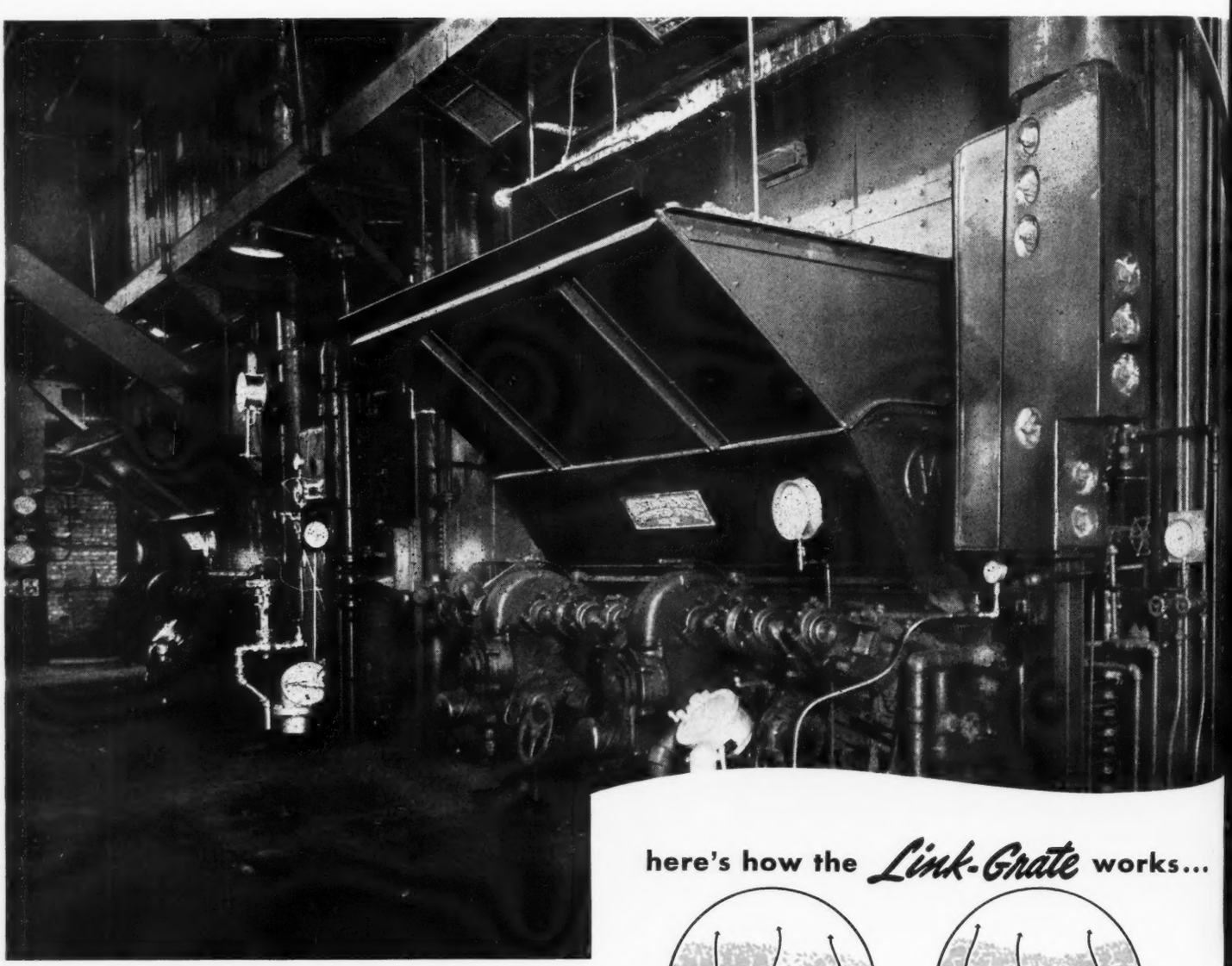
A *Link-Grate* STOKER



here's how the *Link-Grate* works...

GRATES UP

Fuel bed opened, thoroughly permeated with low-pressure air. Fused ash oxidized, clinkers broken into small, friable pieces.

GRATES DOWN

Fuel bed cracked, crumbled and made porous for uniform flow of gases throughout entire combustion zone.

will burn any coal you can get...

effectively

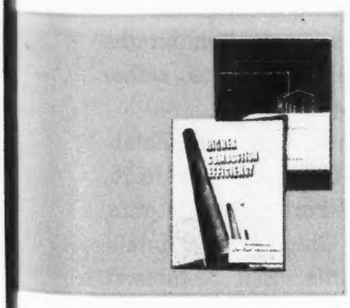
"This fact is important today, may become even more vitally important tomorrow ...Is it true of your present stokers?"

Low-grade Iowa coal is known as a tough fuel to handle, but Iowa Southern Utilities Company burns it regularly at this Ottumwa, Iowa, plant, with an efficiency of approximately 80%. Grate replacements are few, maintenance is low, and normal operating practice calls for continuous service periods of four months or longer for each of these Link-Grate type SDL stokers. This typical example backs up the statement that you can burn any grade of bituminous coal in a Link-Grate stoker—and burn it effectively.

LINK-GRATE MOTION is the secret of fuel flexibility. The fuel bed is kept porous. Continuous motion of the grates prevents formation of troublesome clinkers. An undulating, wavelike motion conveys the entire fuel bed steadily towards the ashpit, and ejects ash off the ash discharge plate at every cycle.

Link-Grate stokers are being used to burn efficiently all grades of bituminous coal—from low grade Iowa coal with 18% ash and 1930° to 2200° F. ash fusion temperature, to premium West Virginia coal with 6% ash and 2500° to 3000° F. ash fusion temperature. This versatility is your assurance of uninterrupted operation. It means long range fuel economy as well, because when free selection is again possible, you will be able to get the greatest amount of heat per dollar of investment in coal.

See Link-Grate stokers in operation, talk with operators and plant management, and get the performance figures. A Westinghouse representative will arrange a visit for you. J-50415



here's how you can get the complete story of low-cost steam

Fuel versatility is one of the many factors contributing to the proved low cost of steam from a Link-Grate stoker. Others include: high availability, low operating and maintenance costs, complete safety, ability to handle wide fluctuations in load. To get the complete story, write for Bulletin 3039 (multiple retort) or 2196-A (single retort). Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

WESTINGHOUSE

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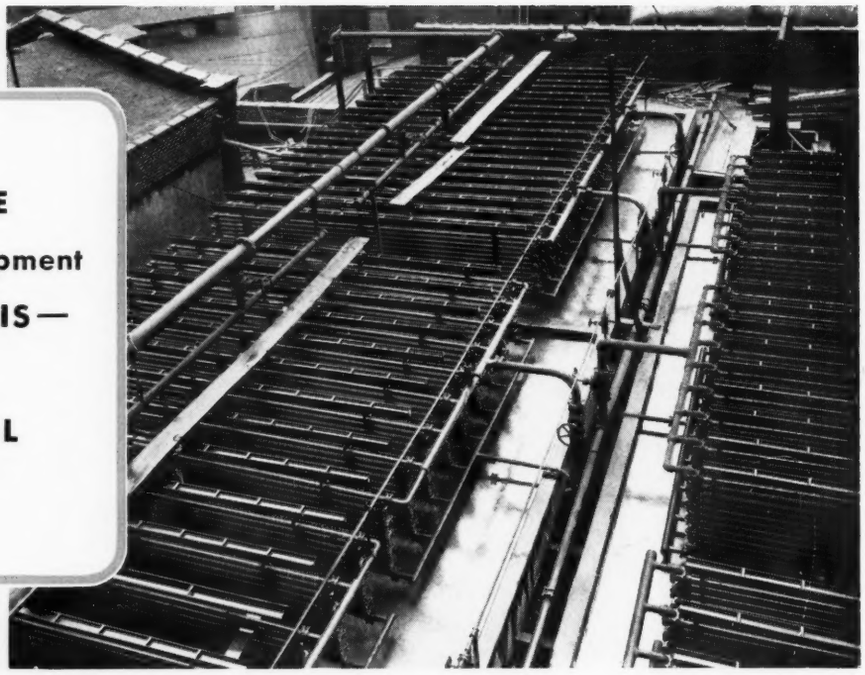
BYERS WROUGHT IRON

If MAINTENANCE
is putting your Plant Equipment
on a PART-TIME BASIS—
the BYERS
EXPERIENCE POOL
can help you!



HEAT EXCHANGERS are highly important production machines in many plants, and must face a wide variety of corrosive conditions. Wrought iron has been extensively used for this service for many years, and its superior durability is a matter of engineering record. For details, see our technical bulletin, "Wrought Iron in Refrigeration and Air Conditioning Systems."

To meet production requirements, vital plant equipment and machinery must now work a 168-hour week. Every shut-down for repairs or maintenance throttles the flow of badly-needed war materials . . . and should be avoided at all costs.

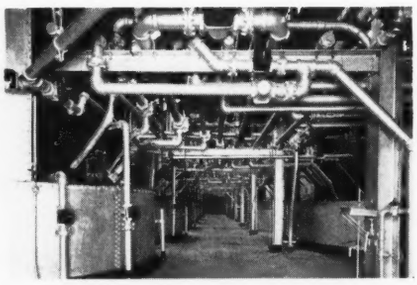
In services where corrosion is a hazard, the first and most important step in avoiding unnecessary repairs is proper selection of materials. The Byers Experience Pool can be of real help to you in this job.

This "Experience Pool" has been built up from reports of engineers on the performance of wrought iron in all sorts of corrosive services. Since wrought iron has been used, sometime or another, in practically all corrosive applications, the Pool provides a surprising number of completely practical answers to today's problems. And there is no obligation, and no red tape, in using it.

If you have any "hot spot" in your plant where corrosion or fatigue are causing frequent failures of ordinary materials, just write us the details. We will check our records, find whether other engineers have used wrought iron in similar services . . . and report their experiences with it. You can then make your selection on the basis of actual experience, rather than experiment.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

SUPPLY AND STORAGE TANKS are called on to handle all sorts of corrosive fluids. Byers Wrought Iron has been successfully used in dozens of varied services. Ask for our Tank Bulletin.



PLANT CONVERSION frequently introduces entirely new problems in connection with process lines, that can be effectively solved with Byers Wrought Iron. Ask for our Piping Bulletin.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
STEEL TUBULAR PRODUCTS

The Aviation Industry is doing its job...

A Year's Production A Week — Every Week

A MERE hundred planes a month in 1938; 200 in 1939; 450 in 1940; 1,600 in 1941, and today, as this is written, plane production goes on at a rate of 5,000 a month. A previous year's production now in one single week — every week.

So begins the story of the greatest industrial expansion in history; an industrial miracle that far surpasses anything our enemies ever have done or can do. Not only did we out-produce the Axis but the acceleration in our production during the past 12 months exceeded the greatest increase in German output during their forced-draft war preparation of 1939, when their production rose from 1,100 to 1,600 planes per month.

The toughest part of our job was accomplished in 20 months. We boosted deliveries from 100 or so to 1,000 planes a week, passing the combined Axis powers. Today, Germany's curve is flattening; ours is climbing steeply. Lt. Gen. Henry H. Arnold, Chief of the Army Air Forces, assures us that Army contractors will produce not less than 148,000 planes in the remainder of 1942 and in 1943. During that same period Navy contractors will turn out at least 37,000 additional planes.

Manpower in the airframe, engine and propeller industries was increased from 125,000 to 450,000 workers during the past 20 months, with the prospect that the industry will be employing more than 1,000,000 men and women in 1943. Many manufacturers are solving their personnel problems by recruiting women workers. More than 40,000 of them — teachers, stenographers, waitresses, housewives and school girls — today are welders, assemblers, machine operators and inspectors on aircraft production lines. Productive floor space in the airframe, engine and propeller industries expanded from 18,000,000 sq. ft. to nearly 55,000,000 sq. ft. during the last 20 months. Further expansion to more than 60,000,000 sq. ft. may be expected this year and an ultimate figure of more than 100,000,000 is a distinct possibility.

To grasp the full magnitude of this task we must remember that a single medium bomber has 30,000 parts, which are built into 650 minor sub-assemblies to make 32 major sub-assemblies. The entire process involves 30,000 man hours of labor. Each of the two engines in this plane requires 50,000 specialized inspections. Every one of the 50 instruments entails many hours of precision workmanship. Yet today there is one factory turning out 4 bombers every day. Another produces fighters at the rate of nearly 20 a day.

To the amazement of the entire world these manufacturing miracles were accomplished without sacrificing the high standard of American aeronautical equipment. There has been some loose talk about the quality of our combat airplanes as compared with those of our allies and our enemies. Indisputable evidence of the superior stamina of our aircraft under fire is written between the lines of almost every war communique. Every battle record tells a story of heavy losses inflicted at small cost upon numerically superior enemy forces. The consistency of this performance on all the far-flung battlefronts constitutes the most eloquent testimony of the high calibre of our designs, our manufacturing methods and the skill and daring of our pilots.

And let us remember that our decisive victory in the battle of production was not won without headaches and heartaches on the part of management, labor and government.

When the President sounded the call for 50,000 planes in the spring of 1940, the program called for only 5,500 military aircraft. Government and industry reeled from the shock — both determined, however, that it *could and would be done.*

The Army, the Navy and the old Defense Advisory Commission set to work to draft a program. This has been revised many times — upward! Congress then proceeded, more slowly, to modify the laws that would have obstructed the realization of the objective. Then the aviation industry, without contracts, in the face of discriminatory profit-limitative legislation, and with nothing but oral assurances of governmental intentions, went ahead with its Herculean expansion plans. New factories were completed long before facilities-contracts and their funds were forthcoming.

The rugged individualists who had founded and built the aviation industry cast aside their rivalries and embarked upon a period of unselfish cooperation. Priceless engineering experience was exchanged. Material was relinquished for transfer to plants where it was needed more urgently. Successful personnel training methods and experience in the use of women workers were pooled for the benefit of all concerned. During one re-

cent month, the cooperation among eight southern California plants averted more than 1,860 potential bottlenecks in production.

As the lessons of the war dictated the need for greater numbers of particular airplane types, many manufacturers accepted orders for planes designed and developed at rival factories. Striking examples are the long range bombers being turned out by plants where only trainers, fighters or dive bombers formerly were made.

Mindful of the risk involved in educating rivals, thereby creating future potential competition, subcontractors nevertheless were sought and trained by pioneer manufacturers. Makers of toys and wheelbarrows, automatic stokers and linoleum were among those who rallied to the call. Within a year subcontracting rose from 13 to 36 per cent of the total program. It still is rising.

When the automotive industry came into the picture, aviation manufacturers gave generously of their time and knowledge to start the newcomers. Liberal licensing arrangements enabled them to reap the full benefits of technical developments. Automotive engineers swarmed through the aviation plants in search of the exacting "know-how" of the aeronautical industry.

Each type of aircraft that reaches the production stage is the result of long periods of research, design and development. The unseen workers toiling in the wind tunnels and the laboratories of government and industry are the unsung heroes who tirelessly are striving to surpass all previous efforts. Their brilliant accomplishments are eloquent testimony of the superiority of men and women who are blessed with freedom of action and thought. Today more than 20 experimental combat airplanes are under development and will replace older types as soon as they fulfill the exacting requirements of our armed forces. Among these are aircraft that promise to outfight and to out-perform any and all of the much vaunted warplanes of the Axis military machine. And this without loss of production.

Every man, woman and child of all the United Nations may fervently be thankful that those who chart our course in aircraft production have not frozen design to such a degree as to make impossible the immediate adoption of improvements as they come out of these laboratories.

What does this brilliant record mean in terms of final victory?

Every newspaper reader has learned this basic war lesson . . . air supremacy is the essential ingredient of military success. As the balance of air power shifts, so do the fortunes of war.

In those dark days when our output was 500 planes a month, Germany's was 2,000 and the German air force was twice that of our Allies. When we reached 2,000 a month last fall, Germany had advanced to a monthly rate of 2,500. Today, as this is written, we have caught up with the enemy's backlog. The air forces of both sides are about equal numerically and United Nations' production exceeds that of the Axis by 27 per cent. Next summer (1943) both the air force and the output of the United Nations will be double those of all the Axis powers.

That is the pattern of ultimate victory!

The pattern of the peace to follow also is gaining in definition. The airplane has shriveled the world to one-fifth its former size. Its use as an instrument of destruction is but a momentary distortion of the pattern of human progress. Its potential power, as a stern preserver of peace, is beyond imagination. Today's air routes of our Army Air Force Ferrying Command are the international trade routes of tomorrow. Giant airliners, by reducing time and space, will speed fraternity among the nations and disunity will give way to better understanding and goodwill.

Flying freight trains, with aerial locomotives towing glider boxcars, will serve large cities, decentralizing population and giving to inland cities many of the commercial advantages of seaports. Air mail and passenger pick-up lines will fill the gaps between these transcontinental trunk lines and tie in the smallest hamlets. Universal fly-it-yourself services will provide airplane facilities for those who do not own low cost private aircraft. Roadable rotary wing aircraft and family planes of the fixed wing type may even run household errands.

The coming generation of business men who today is piloting our war planes will find aircraft as essential to business as it now finds them essential to victory.

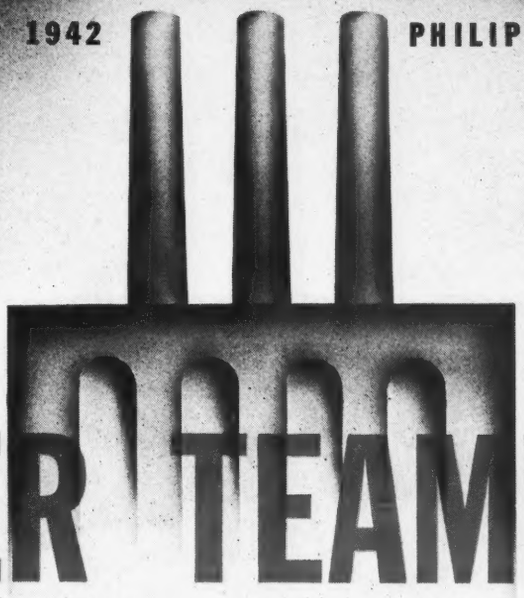
Commenting on our war production record, Donald Nelson has said, "We are today in the position of men who realize that they are actually doing the impossible".

The mass production miracle that the aviation industry – management and workers alike – has performed through the all-out effort of free enterprise can and will serve civilization in peace as it has in war.

With this boundless new medium of transportation and its concurrent technological developments we shall rebuild our way of life to a rich, new fullness upon the ruins of a war-torn world.

President, McGraw-Hill Publishing Company, Inc.

This is the third of a series of editorials appearing monthly in all McGraw-Hill publications reaching more than one and one-half million readers.



POWER TEAMWORK FOR VICTORY

WAR PRODUCTION depends on four primary factors: materials, machines, men and power. At one time or another every one of these has been a limiting factor, except power. So far, despite frequently expressed fears and questions in high quarters, power has never failed America's war program.

Can this sufficiency be maintained through the next two years of supreme struggle on the military and industrial fronts? We believe it can if power engineers will bend every energy to the task ahead.

That task will not be easy; there is no room for complacency. Loads will grow too rapidly at inconvenient points. By WPB order, the electric utilities must make the best of a five-million-kilowatt expansion instead of the eight-million-kilowatts originally planned. Service must somehow be maintained despite acute shortages of steel, copper, rubber and equipment. Key operating and maintenance men will be increasingly lost to the armed services. Yet present and projected capacity can carry the war load despite these obstacles if it is utilized to the limit through cooperative action.

That cooperation is now in the making: Additional utility interconnections are pooling regional capacity to carry local overloads. Many industrials are getting set to pump into the utility lines. Plans are being made to drop certain types of non-essential civilian load in case of dire necessity. To an increasing degree, adjacent industrial plants are pooling steam capacity to serve new and unbalanced demands.

The same kind of cooperation will solve the difficult problem of steam-fuel supply—fundamentally a problem of jammed transportation. Essential power loads will get their fuel, because users will learn to burn the coal from nearby mines, to order fuel in time and to store as necessary.

To a rapidly increasing extent, unused power equipment, regardless of ownership, will be moved wherever needed to maintain essential operation. Finally, manpower, too, will be shared so that available power-plant brains and brawn can cover essential requirements.

Power cooperation in these many forms is now moving forward on a nationwide front. Sooner or later, almost every power engineer must play his part as he faces these problems in his own locality and in his own plant.

This 32-page section is designed to give him a broad view of "Power Teamwork for Victory", with specific examples of tested cooperative solutions. To put it more bluntly, it shows how power and steam services can be maintained despite wartime difficulties, by pooling electricity and steam, by the wise selection and handling of fuel, by neighborly swapping of spare equipment, by shrewd training and placement of the available manpower.

PART

1

War Power Must

PLANNING SOLVES REGIONAL PROBLEMS

5,000,000 kw of new capacity, all we get for the duration, will go where most needed. Interconnections will be operated for maximum use of present equipment and industrial turbines can help. Curtailment may be in prospect next year. With these steps, power equipment can supply war production requirements

ONE LOOK at the national power-consumption curve will convince even the least-informed observer that public-supply generating plants are already carrying greater loads for more hours than ever before in history. Further expansion of war production offers only the prospect of continued increase in power demands for the duration of the war.

Of all the strategic materials that enter the manufacture of war goods, only electric power can still be bought in the open market without priority or without the necessity of curtailing civilian consumption. With present increased reliance of war industries on electric power, particularly the electrochemical and electrometallurgical processes in which electricity is an essential ingredient of the product, a real power shortage would interrupt the flow of vital materials as well as handicap fabrication and assembly operations.

A recent statement by W H Harrison of the War Production Board flatly asserted that no war industry had as yet suffered serious curtailment of its operations through lack of adequate power supply. Looking toward the future, J A Krug, until recently head of the WPB Power Division, has stated "We have sufficient electric power to meet all the requirements of war production and for essential civilian needs, if used wisely, as far as we can see ahead."

PLANNING AHEAD

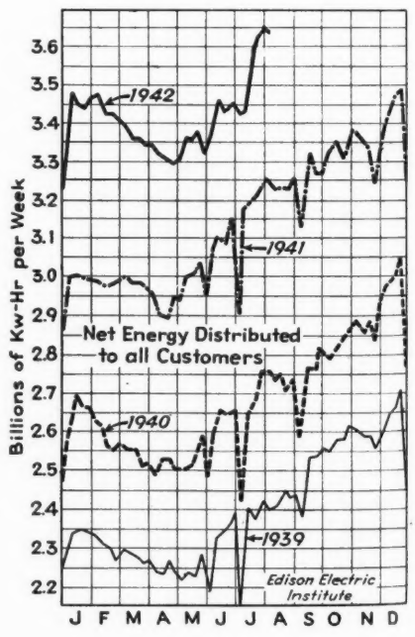
These statements do not indicate that future loads can be met without careful forecasting and planning, or that operators will not have to face a condition that in normal times would be called unsafe. They do represent a mental condition on the part of responsible agencies that war production cannot be allowed to falter for lack of power, if using every kilowatt of utility, government, municipal and industrial capacity to the best advantage can avert a shortage.

All concerned with supplying war power needs agree that the necessary pooling of generating capacity must be considered on a regional basis. Continental United States is divided into a number of geographical areas the natural boundaries of which have not been crossed with transmission lines. Furthermore, within many of these areas there exist certain points where tie-line capacity is small and not designed to serve as interconnection between relatively large systems.

However, the national figures are important in indicating the total available capacity of all kinds. Should power ever become the real limitation on war production in some areas, it might become necessary to limit construction of new power-using plants to other territories having some excess capacity.

CAPACITY MARGIN

As of July 1, 1942, public-supply sources had a total installed capacity of 45,337,000 as reported by the Federal Power Commission. New installations during the first half of 1942 totaled about 1,300,000 kw and will continue at about the same rate for the remainder of the year. Approximately 46,500,000 kw will have to carry at the end of the year aggregate peak loads of about 37,500,000 kw, leaving a margin of reserve about



Total kwhr sales average 12% over last year but at higher load factor

Come From Plants We Have

equal to (and possibly greater than) that of 1941.

New installations under construction or on order for which WPB has granted necessary priorities total about 5,300,000 kw for operation before the end of 1943. (A few of these plants will not start until 1944). Our national generating plant will climb to something slightly over 50,000,000 kw and stay there for the duration, if plans are followed.

POWER PRIORITIES

Whether or not this greatest of all national power plants will carry the war power load is a matter of academic discussion; our real problem is one of determining as far ahead as possible whether any industry necessary to war production will have to close or slow down for lack of power.

Because power is a commodity necessary to the war program, it can be rationed if need be, just as have other strategic materials such as copper and aluminum. Except for a temporary water shortage in the Southeast last year, curtailment of nonessential use and rationing have not been necessary. No such curtailment is in sight for 1942 unless some unforeseen equipment failure or fuel shortage reaches emergency proportions during that period.

ACTIVE PREPARATION

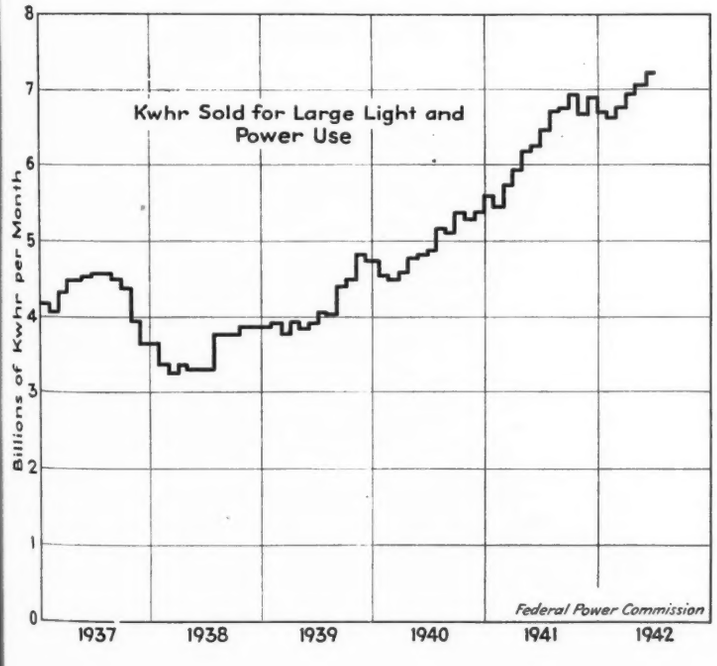
On the other hand, common sense dictates active preparation for emergency situations that might occur in individual power areas. Accidents might occur soon, or never, but preparedness is essential.

Locations of new units have already been established by allocation to critical areas. Beyond these, new machines can no longer be obtained to bolster weak spots. Plans call for a minimum of new interconnections (because of material shortages) and these only where determined to be essential to the war effort.

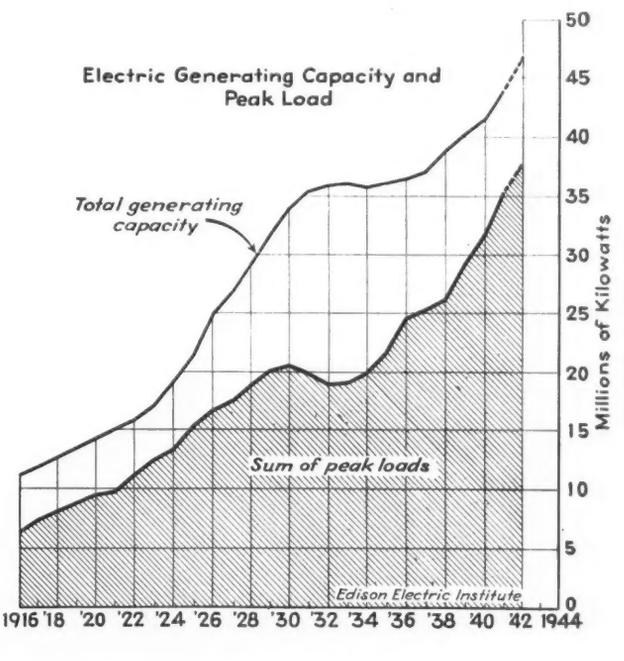
Machinery for getting the most out of all the generating capacity of any power area has been set up in WPB Limitation Order L-94. One part of this order will have far-reaching effect on industrial plants as well as utilities. To prepare for pooling of generator capacity in their territories, utilities are charged with the responsibility of surveying the areas served (1) to list all industrial plants having over 100 kw of generating capacity (2) establish the approximate number of kw and kwhr that might be available in the pool, and (3) prepare estimates of the materials and costs of interconnection. Obviously, these interconnections will be carried out only when and if necessary and with use of a minimum of strategic materials.

SHORTAGE BY DECREE

Another part of the order provides for definite declaration of emergency within a definite geographical area when a shortage occurs or when one can be foreseen. When necessary, therefore, operation of generating equipment can be dictated on the basis of maximum benefit to war production rather than the usual basis of "least cost" or "safe" operation.



Large power users take more than a proportionate share of kwhr production indicating continued rise in output of munitions



Margin between total generating capacity and aggregate peak loads for 1942 will about equal that of 1941

1 POOLING POWER

Planned Interchange for

THE FIRST STEP in maximum utilization of public power supplies has already been partially carried out. For more than twenty years the utilities have been building integrated systems with transmission ties for interchange of power within ever-expanding geographical divisions. These interconnections between operating companies and with individual company systems were made to lower over-all costs of operation by using best equipment for generation of kwhr and older or less efficient machines for reserves.

Inherently, these interconnections have made reserves of one plant or system available to other plants and systems. Coupled with gradually increased reliability of steam power equipment, they have permitted safe operation with smaller percentages of reserve equipment.

Unfortunately for war production, these systems have grown around existing centers of population where industrial and residential demands were increasing. Strategic location of war industries inland and away from large cities now requires "transportation" of power from existing sources to new locations. In this way every extension to aluminum and magnesium production has caused a local shortage of power. These plants present specific problems and each has been served by one or another feasible solution that has taken into account the local situation.

REGIONAL SHORTAGE

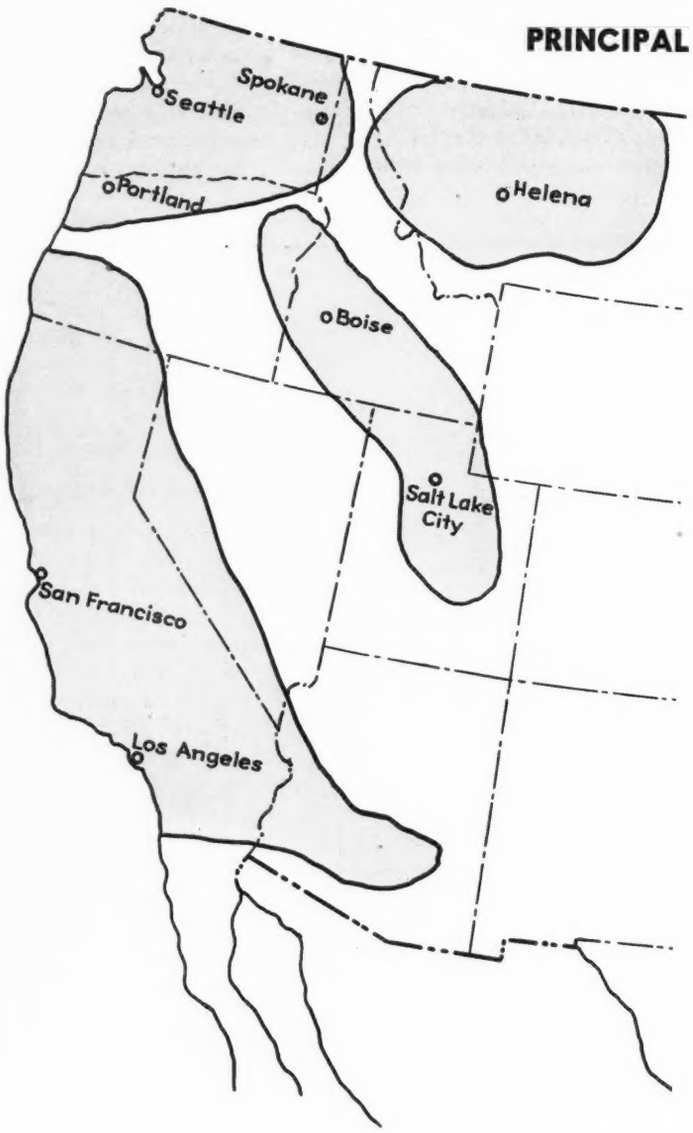
A general power shortage extending over a wide area and affecting many war-production plants presents an entirely different problem. It affects *operation* of plants within the area rather than *construction* of new feeder lines and interconnections.

The outline and scope of general area shortages is well illustrated by the experience of last year in the Southeast, where, for a time, a shortage of kw and kwhr both were experienced. A shortage of kwhr, according to C A Collier, Vice-President of Georgia Power Co, requires curtailing non-essential uses. A shortage of kw is met by shifting loads, where possible, from peak periods to other times of lesser demand. Where both kw and kwhr are limited the combined problem of shifting and curtailing becomes extremely difficult to handle.

A kwhr shortage normally occurs only through failure of water or fuel supply to hydro or steam plants respectively. In general, fuel and water supplies are beyond the control of plant operators, cannot be controlled by planning ahead, and extend over relatively wide areas. Such a condition may well exist in New England in the not too far distant future since water-borne oil and coal may have to be curtailed to all power plants.

In the event of a kwhr shortage, the War Production Board is specifically empowered to declare the limits of the area affected and restrict consumption of electrical energy for non-essential uses. In the latter class are placed air conditioning and refrigeration (where not essential for industrial process), heating for trolley and railroad passenger cars, sign and show-case lighting, ornamental, decorative, advertising or flood lighting, and highway lighting above minimum requirements for safety. A further limitation may be imposed on all interior lighting of stores and other commercial establishments to reduce intensities to one watt per sq ft of floor area.

The extent to which curtailment is imposed will, of course, depend on the seriousness of the shortage. Experience in the Southeast indicates that a complete and well thought out publicity and advertising campaign



Public Power Production

on the part of the local utility company will produce an almost immediate reduction in kwhr use of from 5 to 20% among various classes of customers served.

SHIFTING LOADS

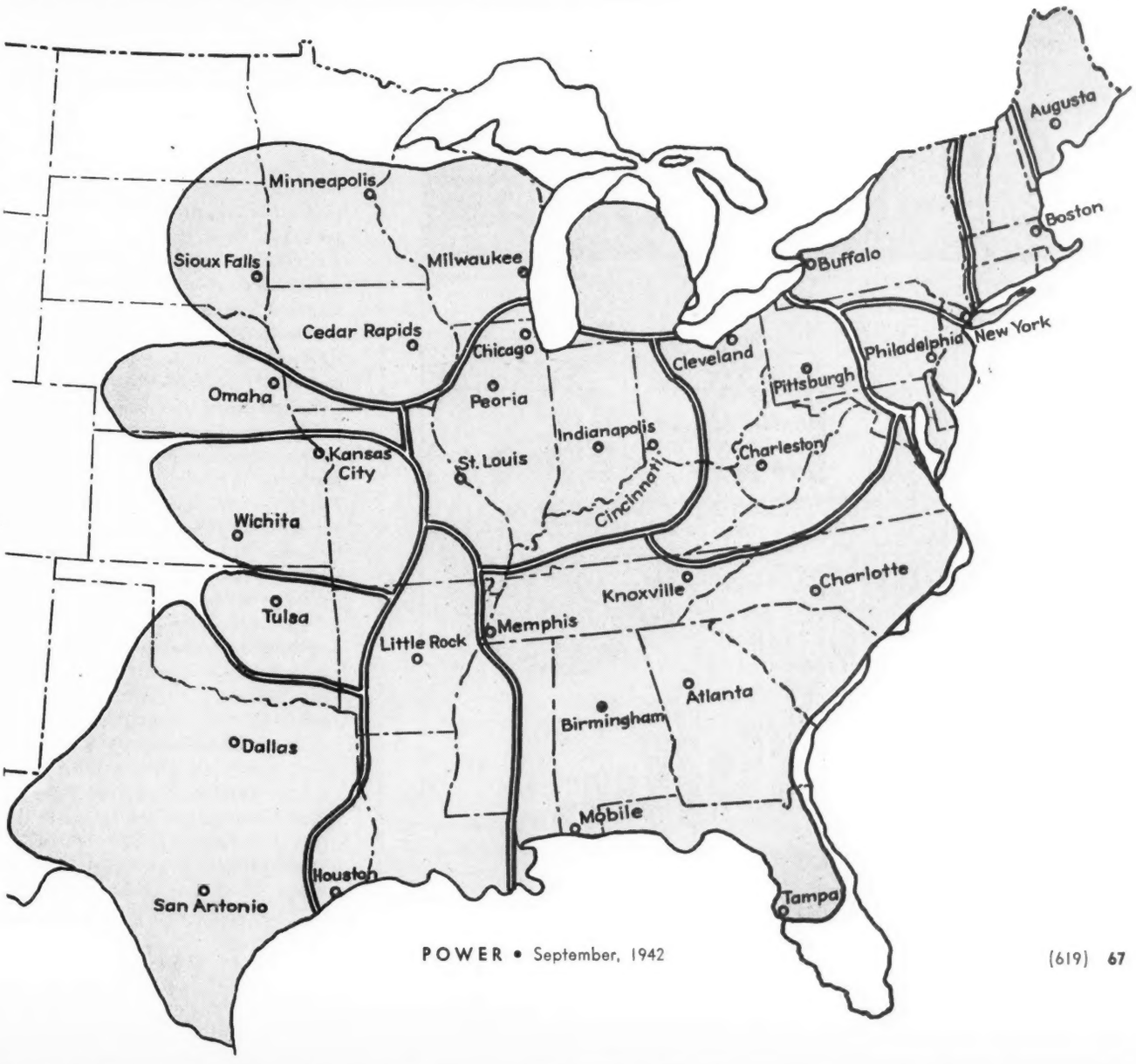
A shortage of generating capacity, on the other hand, unaccompanied by lack of hydro water supply or fuel, requires shifting loads from peak periods to other times of lesser load demand, importing power into an affected area, interconnecting with excess industrial plant capacity, or perhaps all of these. If the deficiency of supply comes about through construction of new industries or relatively gradual growth of existing plant loads, the narrowing margin of safety should be visible for many months before the shortage is acute.

Potentialities for shortage of generating capacity exist in many areas where new war-production plants have been built, but none are expected to reach the acute stage in 1942. Allocation of new units to the most critical regions has already been completed. Increased interconnection has been studied and certain ties authorized. Specific local problems have been met by cooperative effort among the public supply agencies concerned.

For example, the War Production Board has effected an integration of public and private electric utilities in Southern California based on plans originally worked out by the Power Committee of the California Council for Defense, a committee headed by E F Scattergood of the Los Angeles Bureau of Power and Light. To release turbine-building capacity to warships and merchant marine, the utilities in this area have pooled reserves to postpone installation of a large turbine unit. All concerned recognized that the revised system of operating tie-line interconnections involved risk of impairing electric service in the area affected.

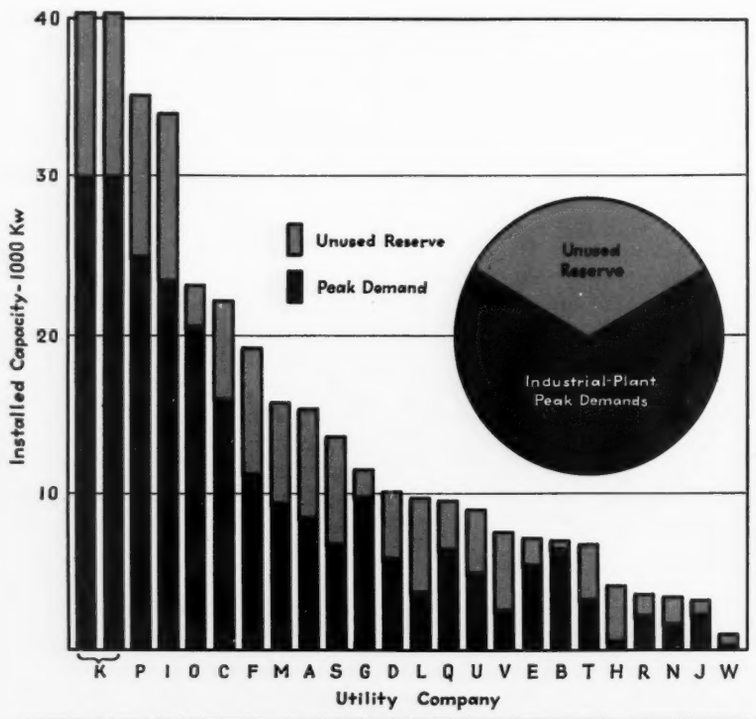
Numerous other examples include an interchange agreement between private companies and the Bonneville Administration in the Pacific Northwest, a pooling of facilities to serve an aluminum plant in Arkansas and integrated operation of the 25-cycle system in up-state New York.

GEOGRAPHICAL AREAS OF INTEGRATED SYSTEMS

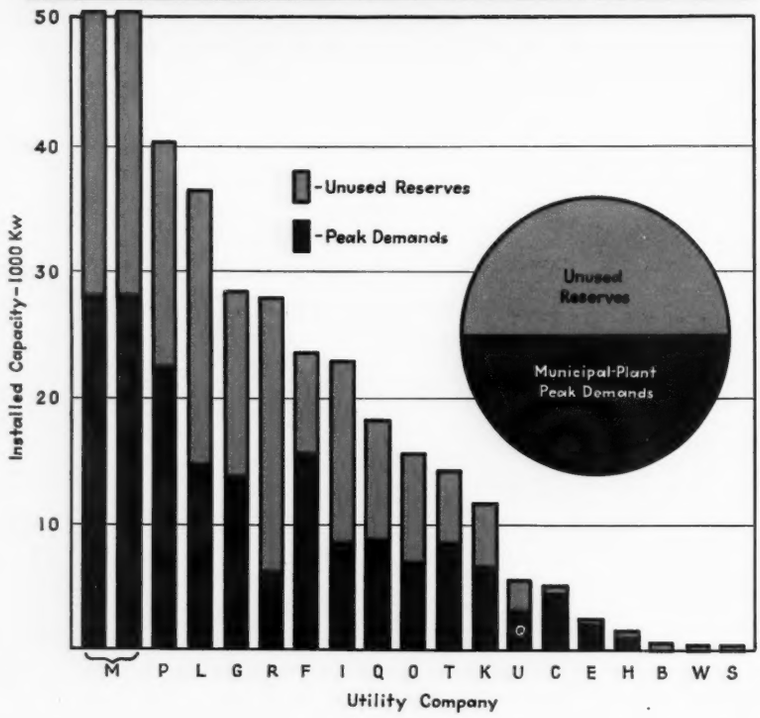


1 POOLING POWER

Survey Measures Non-Utility



Study* indicates that one-third of aggregate capacity of industrial plants in the territories of 23 utilities could be made available by interconnection; practically half of municipal capacity in the same areas could contribute. Wide variation in available kw of individual systems must be taken into account by local surveys



PERHAPS THE BEST ORGANIZED and most complete search for available sources of reserve power that has ever been undertaken is now gathering momentum in Washington. The Power Division of the War Production Board will shortly have records of every industrial, institutional and other special-purpose generating plant having more than 100 kw of installed capacity.

Unlike previous studies such as the Census and those of the Federal Power Commission, the burden of accumulating accurate data on the many thousands of smaller electric producers has been placed squarely on the doorsteps of public utilities and other public-supply agencies. Contact men are now covering their own territories in the search for unused or partly used generating equipment in industrial plants, hospitals, hotels and all other locations that might possibly contribute to a local power pool.

HOW MUCH TO SPARE?

Not only will the WPB know for any area, the plant location, fuel used, and the type of prime mover, they will check each for an accurate estimate of how many kw and kwhr could be spared from normal requirements for pooling. Also requested is such information as total cost for repairs and new equipment necessary to operate the individual plants at full capacity and to make the power so generated available to transmission and distribution facilities.

Obviously no immediate nationwide wave of interconnection will follow the tabulation of these data. There is no incentive to allocate precious copper and other materials to areas that now have adequate or excess power supply from usual sources. Neither would it make sense to undertake high-cost interconnection of more remotely located plants where only a few extra kw would result. Experience in the Southeast during last year's drought taught the value of interconnecting such non-utility plants as could be brought in quickly and at least cost. This survey, when completed, will save waste motion in choosing plants for which interconnection is practical and economical in an emergency.

All concerned with averting power

Kilowatts for Future Pooling

shortages will agree that the safest and most satisfactory solution is to have enough capacity on the job to meet the load, plus a safe margin of reserve. We no longer have unlimited turbine-building plants or materials; every land machine not ordered releases materials for marine turbines. New turbines already under construction have been allocated to most critical areas. Other regions will have to get along as they can.

Faced with known risks, public-supply systems must operate on gradually decreasing reserves. This is not a matter of choice but one of necessity. Thus the possibilities of power shortages caused by accident or other emergency has been increased. Power shortages, if they occur, can no longer be charged to unwise planning or delinquency in necessary expansion of facilities.

NO SHORTAGE PREDICTABLE

No one knows where equipment failure or delayed installation schedules might create a critical power situation next year. None are predictable at present. Rainfall in previously drought-stricken regions has removed them from the critical list.

In preparation for almost inevitable future emergencies rather than for immediate action, the secondary reserves afforded by unused margins of capacity in non-utility power plants are being surveyed. While data are being collected for WPB in this connection, results of a similar survey* indicate that something like 3,000,000 kw of non-utility reserve generator capacity might be available from complete pooling, insofar as is practical, of all isolated installations.

This study of industrial and municipal plants within the territories of 23 representative operating utility companies shows 117,000 kw of unused reserve equipment in industrial plants and 176,000 kw in municipal plants. These figures represent the totaling of individual differences between nameplates and peak loads.

This study specifically states that it is a suggestion for a possible program rather than itself constituting such a program. It is a sampling of representative areas that indicates the possibility of finding 3,000,000 kw in the entire country. Final tabulation of the WPB study may show a considerably different amount that can advantageously be interconnected with utility lines. However, all plants under 100 kw, all dc generation, and all plants of "disproportionately high cost" have been eliminated so that the sample study should closely parallel the present WPB survey.

Some practical limitations on interconnection have been indicated in this study. Some plants with old or inefficient equipment may not be able to run at full load. Others may now have taken on war contracts. Deficiency in boiler capacity or fuel supply may limit maximum output. Repairs, and lack of parts or skilled labor may prevent full utilization of the nominal plant capacity.

Limited to feasible interconnections, rough estimates of cost for transformers, switches and accessories total less than $20 per kw.

ESTIMATED GENERATING CAPACITY AND OUTPUT OF INDUSTRIAL AND MUNICIPAL POWER PLANTS IN TERRITORIES SERVED BY 23 UTILITIES

UTILITY COMPANY	INSTALLED NON-UTILITY CAPACITY (KW)	PRESENT MAXIMUM DEMAND (KW)	UNUSED CAPACITY (KW)	ANNUAL OUTPUT 1941 (KWHR)
A	15,400	8,300	7,100	63,400,000
B	7,300	6,500	800	19,300,000
C	27,400	20,700	6,700	81,800,000
D	10,300	5,700	4,600	11,200,000
E	9,300	7,300	2,000	14,100,000
F	43,000	27,000	16,000	106,600,000
G	39,900	23,700	16,200	91,000,000
H	5,500	1,300	4,200	3,400,000
I	56,800	32,000	24,800	138,400,000
J	3,100	2,300	800	3,100,000
K	92,300	66,700	25,600	304,800,000
L	46,200	18,200	28,000	78,900,000
M	116,200	65,400	50,800	274,900,000
N	3,300	1,700	1,600	3,200,000
O	38,800	27,500	11,300	115,100,000
P	75,000	47,200	27,800	165,600,000
Q	27,800	15,200	12,600	51,800,000
R	31,400	8,100	23,300	37,000,000
S	13,800	6,600	7,200	25,000,000
T	20,900	11,700	9,200	44,500,000
U	14,400	8,000	6,400	32,000,000
V	7,500	2,400	5,100	13,400,000
W	1,100	100	1,000	100,000
TOTALS	706,700	413,600	293,100	2,136,000,000

* Edison Electric Institute Bulletin, July, 1942. (Ebasco Services, Inc)

Industrial Plants

BEFORE EMERGENCY OCCURS

War Production Board

↓ Issues Order L-94

Power Division

↓ Initiates survey of all non-utility plants with over 100 kw generating capacity

Public Utility: Private, gov't, municipal, other

↓ Contacts industrial, institutional and other plants in territory served to obtain data

Contact Representative

↓ Gets figures from power engineer

Industrial Plant (non-utility)

↓ Supplies technical data and estimates costs within plant

MORE THAN 16,000,000 kw of generating equipment in industrial power plants, and uncounted millions more in institutions, hotels, laundries and other miscellaneous classifications will be partly mobilized for war production. Like the draft of men for the Army, physically able plants without too many existing dependents will be called first. But all must register!

If your plant has more than 100 kw of installed generating capacity, you are affected by War Production Board order L-94. The WPB wants to know how much excess kw and kwhr you could deliver over and above your own normal needs if you were interconnected in a power pool.

RECORD PLANT DATA

Every power engineer should collect and have available the information called for in the table on these pages. In addition, write down on a separate sheet of paper whether your plant is condensing or non-condensing and approximately what the fuel consumption per kwhr or per lb of steam is. Can your prime movers handle loads above their nameplate capacity? Are they in good condition, or would they be weak members of a power pool? Do you have excess steaming capacity? How much of your normal load could be cut out in time of emergency? How much is used in making war goods or "near-war" goods and how much of the power output goes into non-essentials that could be temporarily held up if it came to a choice between helping win a war and maintaining profit levels?

Note the last five columns of the form. It takes copper and steel to make electrical connections and the dollars and cents measure how much precious metal it will take to get each kilowatt in harness. Following pages detail what equipment interconnected operation requires. Your estimate need include only the costs within the plant; those responsible for the pooling will figure transmission and distribution needs.

The local utility company, whether privately owned, government or municipal, is charged with the responsibility of getting this information about your plant and all others in their territory. Their "power salesmen" are required by WPB to call on you, not to sell power, but to buy it. You incur no obligation by giving them full and complete information; WPB already has pretty much all the authority they need to take power where they find it if it comes to a show down between war goods and non-essential use. If this sounds strange, try to buy copper.

EXPERIENCE HELPS

Joint operation of industrial and utility generators is an old story to many power men. Most existing interconnections, however, were made primarily for economic reasons. Process demands of many manufacturing plants require generation of steam that can produce more byproduct power than the production line requires at costs less than even the most efficient condensing turbines can show. Now, in emergency conditions, cost is of secondary importance and the incentive to pool capacity comes from the power needs of the war-production effort.

That the problems of interconnection can be worked out is well illus-

DATA ON GENERATING FACILITIES

	Name of Non-Utility Producer	Plant Location	Product	Inter connected	Capacity of Present Inter connection	Energy Data — Estimated for 1942 (KW Hours in 1000's)					
						Energy Purchased		Energy Generated		Sales to Others	Used in Industrial Operations
				yes or no	kw	Kwhr	Kw Demand	Kwhr	Kw Demand	kwhr	kwhr
		b	c	d	e	f	g	h	i	j	k
1											
2											
3											
4											
5											
6											
19											
20											

Share Responsibility

trated by highly successful cases that have already proved the advantages of joint operation to all concerned. For example, a power pool near Chicago involves many of the steel mills and all of the utilities in that area. A similar interconnection of steel mills exists in the Pittsburgh area. One mid-western industrial buys steam, from the local utility company, that has already been used for power generation in a topping unit. Several large paper companies, with interchange arrangements, have swapped both steam and kwhr between plants and with utility stations for years.

TO CUT COSTS

Food and chemical industries, typical large users of process steam, have worked out backpressure and extraction-turbine arrangements that have become economic as well as practical operating successes. Ownership and management of the individual plants seems to make little difference provided the accounting procedure takes care of sharing the cost.

These instances are cited to indicate that interconnections made to meet an emergency condition may be worked out to the advantage of the industrial plant not only for the duration of the war but during post-war readjustments as well. Lessons learned from the economically inspired past interconnections can be well utilized to meet the needs of war emergency pooling.

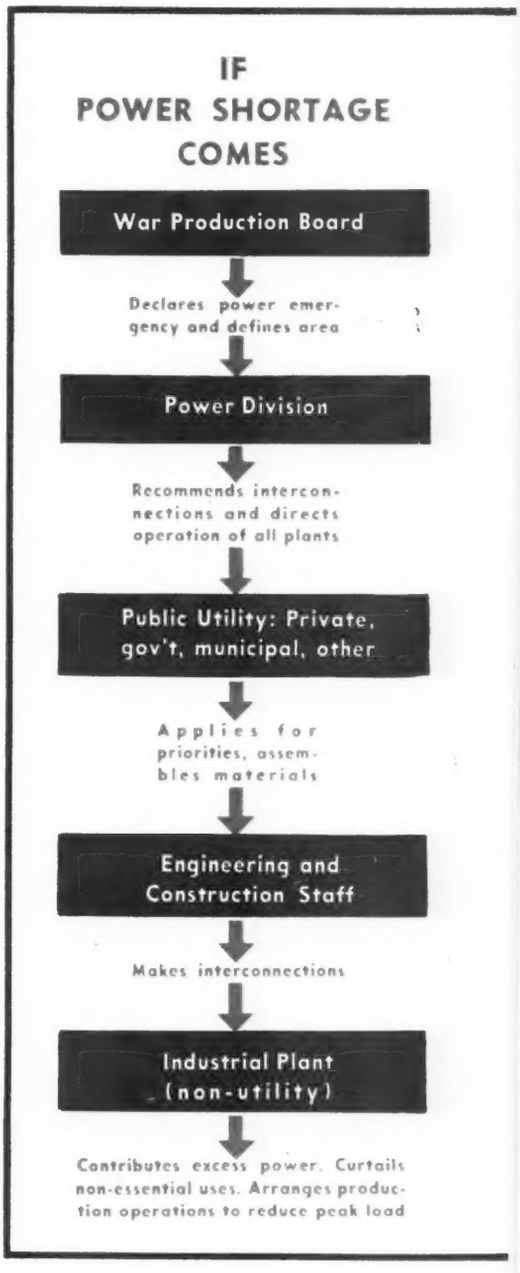
All this is paper planning for emergencies that may never happen in your neighborhood. There are no power shortages on the horizon now. Real shortages in materials will probably keep the war production machine from running away. But planning beforehand how to meet power emergencies is essential to averting serious curtailment of war production and civilian requirements.

IT WORKED ONCE

Experience in the Southeast during last year's drought indicates that industrial generating capacity can contribute greatly to the relief of power shortage. Customers' plants were tied in and the utility bought all the kwhr industrials were able to deliver. Much of the equipment was old and inefficient, but fuel supplies were not limited and the older machinery could still run—and did.

Temporary interconnection with a utility or municipal system does not involve a bona fide industrial power plant in the maze of government regulations under which the utilities operate. The accounting problems of power cost were settled without difficulty by the Southern power companies last year and there is every indication that satisfactory financial arrangements can be completed on the spot when an emergency arises.

Those who purchase power in amounts over 2500 kwhr per week or who have a demand over 50 kw are subject to curtailment if necessary in power-shortage areas. Depending on the degree of severity of the shortage, large users will be rationed at a to-be-fixed percentage of their present consumptions, both kwhr and kw. Specifically exempted from this rationing are essential fire systems, police services and essential street lighting, transportation and communication services and their repair shops, pumping stations, and munitions plants.


IF
POWER SHORTAGE
COMES
War Production Board
Declares power emergency and defines area
Power Division
Recommends interconnections and directs operation of all plants
Public Utility: Private, gov't, municipal, other
Applies for priorities, assembles materials
Engineering and Construction Staff
Makes interconnections
Industrial Plant (non-utility)
Contributes excess power. Curtails non-essential uses. Arranges production operations to reduce peak load

OF NON-UTILITY PRODUCERS

Name plate Capacity kw	Type of Prime Mover	Kind of Fuel Used	What Other Fuel Can Be Used	Estimated — 1942 Peak Demand Industry Load kw		Estimated Power Available to Utility				Cost of Materials for Interconnection				Remarks
						July		December		Repairs to Generating Equipment	Lines and Substations	Cost of Materials Per Kw of Capacity (Do Not Fill In)		
				July	December	Kw	1000's Kwhr	Kw	1000's Kwhr					
l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
														1
														2
														3
														4
														5
														6
														19
														20

PART 2

HOW TO POOL POWER

For successful pooling, the engineer must provide for control of power flow between systems, circuit and equipment protection, increased circuit-breaker capacity and metering. Based on actual cases, this section covers practical phases

Industrial-Plant Operators Share 'Tie-in' Experience

SEVERAL INDUSTRIAL PLANTS have operated in parallel with utility systems for a number of years. They have learned by experience how interconnection can be made mutually advantageous and, more particularly, they have learned what the industrial plant must do to make such pooling successful. The following six cases, representing a wide range of plants and operating conditions, give a good view of the general aspects of the problem, a necessary prerequisite to the discussion of practical details of load control, protection, circuit breakers and metering.

Fig. 1 shows the general setup in one typical plant. The industrial power plant contains a 625-kva hydroelectric generator, and 850-kva and 250-kva steam-driven generators. All are designed for 2300 volts, 0.80 power factor and 60 cycles. A 2500-kva line ties to the local public utility system. Power is distributed to the manufacturing shops and foundry at 2300 volts over six feeders. The shop load amounts to about 1200 kw and in the foundry an electric furnace takes 1400 kw, making a total load of about 2600 kw.

STEAM-DRIVEN UNITS

The steam-engine-driven units operate in emergencies when wires go down and utility power fails, or when there is a shortage of exhaust steam for heating. Steam-driven air compressors and pumps normally supply this steam. During the day, the compressed-air load insures enough exhaust steam for heating, but at night the air load is light. If at this time water flow in the river is not enough to supply the electrical load, the small steam-engine-driven generator operates in parallel with the utility system, the latter taking the peaks.

During the day the hydro unit carries as much load as water flow permits, with the utility making up any difference between plant load and hydro output. At night, when only the shop is operating and there is plenty of water, the hydro unit can supply plant load and more; excess power goes to the utility system. Power supplied to the utility under these conditions is metered and a record kept by the industrial plant, but the utility is not charged. The water cannot be stored and the utility does not need the power, so that there is really no good reason for charging. This arrangement permits operating with a constant load on the hydro unit, while the utility provides the frequency regulation. This method of operation saves wear and tear on the hydro-unit governor and prevents surges in the penstock.

LOW-WATER OPERATION

During low water the hydro unit is loaded by automatic control to utilize all the water available at maximum head. This is done by adjusting the turbine-gate position by means of a float in the forebay connected to the governor motor by selsyns. When operating this way the generator is over-excited to supply as much of the reactive kva load as possible and thus improve the power factor and voltage regulation on the utility line. A recording strip-chart power-factor meter on the switchboard gives a continuous record of power factor on the utility line. Charges for power are increased if the average power factor for the month, as determined from the kilowatt-hour and the reactive-kva-hour meter readings, is less than 0.80.

When utility lines are down, the industrial plant supplies power to the town load, with the exception of the industries. During these periods, and at any other time that the utility asks for power, the energy used is purchased. The meter recording outgoing power is read before and after each emergency period and the utility billed accordingly.

The plant is equipped with automatic voltage regulators which are cut out of service when the plant is

tied in with the public utility and the voltage regulated manually. This plant operates without a frequency meter; the utility regulates frequency during parallel operation and the governor speed indicator checks frequency when the industrial plant operates independently.

Several interesting conditions exist on this system. The ground detector on the switchboard shows a ground anywhere on the utility system in town or on the plant system. When a ground develops it is then necessary to open either the utility tie switch or the plant switches one at a time to determine if the fault is on the town or the plant circuits.

Trouble is experienced with thunder storms. All the utility lines run either in or across a river valley and most of the storms follow the river. Many of the lightning discharges hit the utility lines, come into the plant and trip out the circuit breakers. During a bad storm, lightning may keep the operator busy synchronizing the hydro unit with the utility system and closing switches. When conditions get too bad the two systems are separated until the worst of the storm is over. Lightning arresters on the incoming lines do not always lead the lightning discharges to ground and they have on occasions broken down the insulation on conductors where they entered a conduit, going to ground at that point.

CLEANS TURBINE RUNNER

During or shortly after a heavy rain, paper and trash get through the racks and lodge on or between the turbine buckets or fold over their edges and may reduce the power of the unit 10 to 20%. This trouble is corrected easily by closing the turbine gates and letting the unit motor on utility power for about a minute. This washes the trash clear of the wheel and restores it to full power. To do this without the reverse power relays tripping out the hydro-unit switch the relays are set to trip at a higher current than required to motorize the hydro generator.

In this case, power pooling has proved mutually beneficial to both parties and both cooperate to give the community the best possible service with the available equipment and the conditions under which it operates.

Fig. 2, on page 74, shows the arrangement of another industrial tie with a large utility system. The powerhouse contains four steam-turbine-driven generators. Two of these are rated 1000 and 1500 kw, respectively, and operate on 400-psi steam. The 1000-kw unit exhausts 85 psi, and the 1500-psi unit bleeds at 85 and exhausts at 5 psi gage. No. 3 unit, rated 350 kw, operates condensing on 5-psi steam from the exhaust header, to maintain summer heat balance. No. 4, a 250-kw unit, takes steam from the 85-psi header and exhausts into the 5-psi line to supply additional low-pressure steam in winter for heating.

Load on this plant increased until it was necessary to install an additional unit. As this was not readily available and the utility had ample capacity it was decided to interconnect. The tie is made through a 2000-kva bank of transformers that steps the power down from 4000 to 440 volts, the voltage on the plant bus.

Before the connection was made, the engineers studied the short-circuit currents that might be encountered when the additional capacity was connected into the system. These currents were found to exceed the capacity of all the feeder oil switches and those on the two smaller generators. As the voltage was well within the range of standard air circuit breakers, air-break units of ample capacity to handle the expected short-circuit currents, were installed. These eliminated any danger from oil fires in case of breaker failure and required less space to install than oil circuit breakers.

OVERLOAD PROTECTION

The two large generators do not have overload protection, but are protected against internal faults by differential relays, Fig. 3, page 79. The two smaller generators have overload protection but not differential relays. On the utility connection, reverse-power relays trip the circuit breaker if the power plant starts to feed into this line. This connection is also protected with overload relays that trip the circuit breaker at about 20% sustained overload.

Power is purchased on a flat-charge-per-month basis for the breakdown connection and a maximum-demand and kilowatt-hour charge for all power used. In this plant the power and low-pressure-steam requirements are such that the most economical heat and power balance is obtained when a 200-kw constant load (about 144,000 kwhr per month) is taken from the utility line. This load is held constant by automatic control

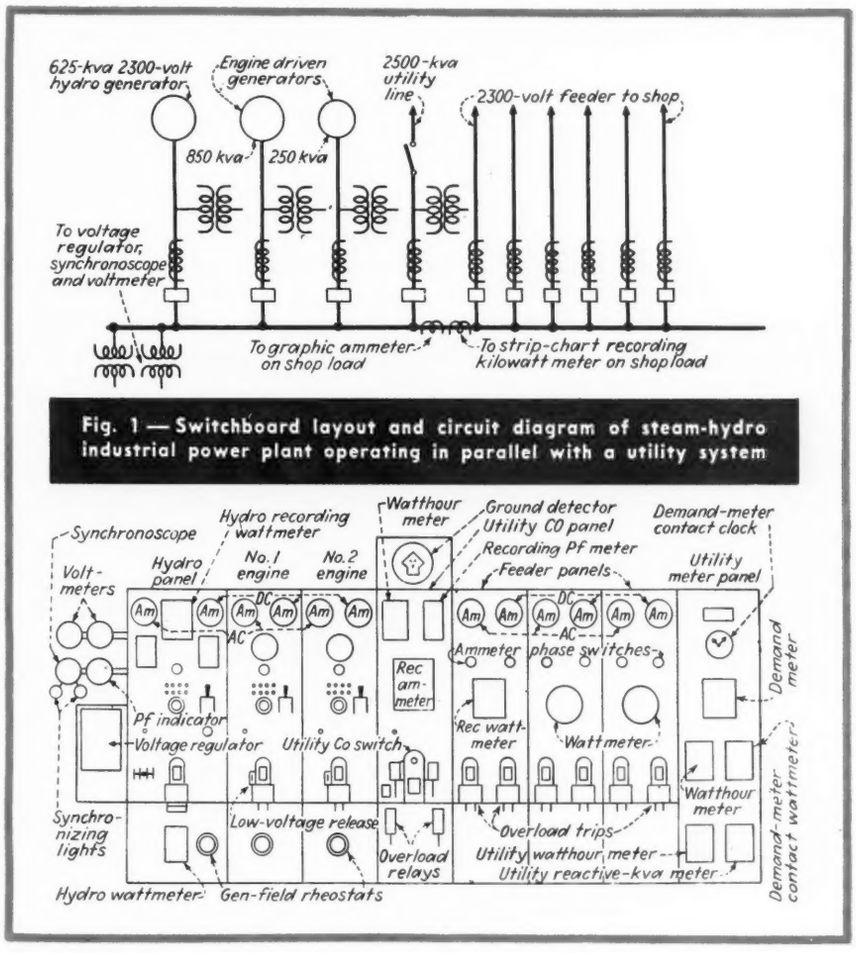


Fig. 1 — Switchboard layout and circuit diagram of steam-hydro industrial power plant operating in parallel with a utility system

acting on the turbine governors to make their generators take all load over 200 kw. The automatic control also divides load between generators. These controls are similar to those in Fig. 1, page 76. When the 250-kw unit is operated in the winter its load is controlled automatically to maintain pressure in the low-pressure steam header between 5 and 7 psi.

The contract calls for a power factor of not less than 0.80. Even though plant power factor is about 0.70 at the busbars, generator excitation is adjusted manually to maintain better than 0.80 on the utility tie. The generators are equipped with automatic voltage regulators, but it was found that more satisfactory operation could be obtained with manual voltage control.

OPERATING EXPERIENCE

No serious difficulties have been experienced in this plant when it has been operating interconnected with the utility system. Trouble was encountered in maintaining proper division of load between the two generators. This was caused by one governor motor responding more quickly to the control than the other. The machine with the more responsive governor motor would tend to take all the load. This difficulty has been corrected by changing one of the governor motors to match the response characteristics of the other.

The utility tie to this plant comes in overhead and the plant also has some overhead lines. However, no trouble with lightning has occurred, probably because two 275-ft stacks are equipped with lightning protectors. Lightning strikes these stacks and is carried to ground through the protective devices.

The simplified diagram Fig. 3, represents a large industrial plant that contains three 5000-kva turbine-driven units and operates in parallel with a medium-size utility system. Steam pressure is 600 psi gage. No. 1 turbine takes steam at 600 psi, bleeds at 150 and exhausts at 40. No. 2 unit operates on 600-psi steam, bleeds into the 40-psi header and exhausts to a condenser to maintain heat balance. These were the conditions when the plant went into operation with the local utility tied to the bus. The utility line was metered to measure power flow in either direction, each party having its own metering equipment.

In this case the industrial plant was fairly well loaded continuously. The tie to the utility system provided an emergency power connection which supplied power when the plant was shut down during maintenance periods. The utility was short on reserve capacity and used the tie to take any excess power that the industrial plant had available. This made the situation one in which both parties were mutually interested, and each paid for the power taken from the other's system, at the same rate.

Because of conditions that existed in both systems they did not operate very satisfactorily in parallel. This was particularly true during thunder storms because the utility lines were overhead and the tie coming into the industrial plant was not protected by lightning arresters.

The load increased on the industrial plant to such an extent that its engineers decided that a third unit was justified, and as this unit was available in another mill it was moved and installed. This machine operates condensing and takes steam from the 150-psi line. When this unit was installed changes were made in the bus arrangement so that the new machine and the utility tie now connect to the same bus section. An oil circuit breaker connects this section to the main station bus. All power from No. 3 goes to the utility system and is charged for at a rate adequate to cover generation cost. Normally the bus sectionalizing switch stands open so that unit No. 3 and the utility tie are isolated from units No. 1 and 2. Thus any disturbances from the utility system do not interfere with mill operation.

If it is necessary to take either unit No. 1 or No. 2 out of service the sectionalizing switch can be closed and the two available units operated in parallel with the utility. When the mill shuts down, operators close the sectionalizing switch and take units No. 1 and 2 out of service. Under these conditions power from unit No. 3 supplies the mill, but if the utility company does not need power unit No. 3 is shut down and the mill takes maintenance power from the utility tie.

This arrangement has worked satisfactorily, as unit No. 3 provides the

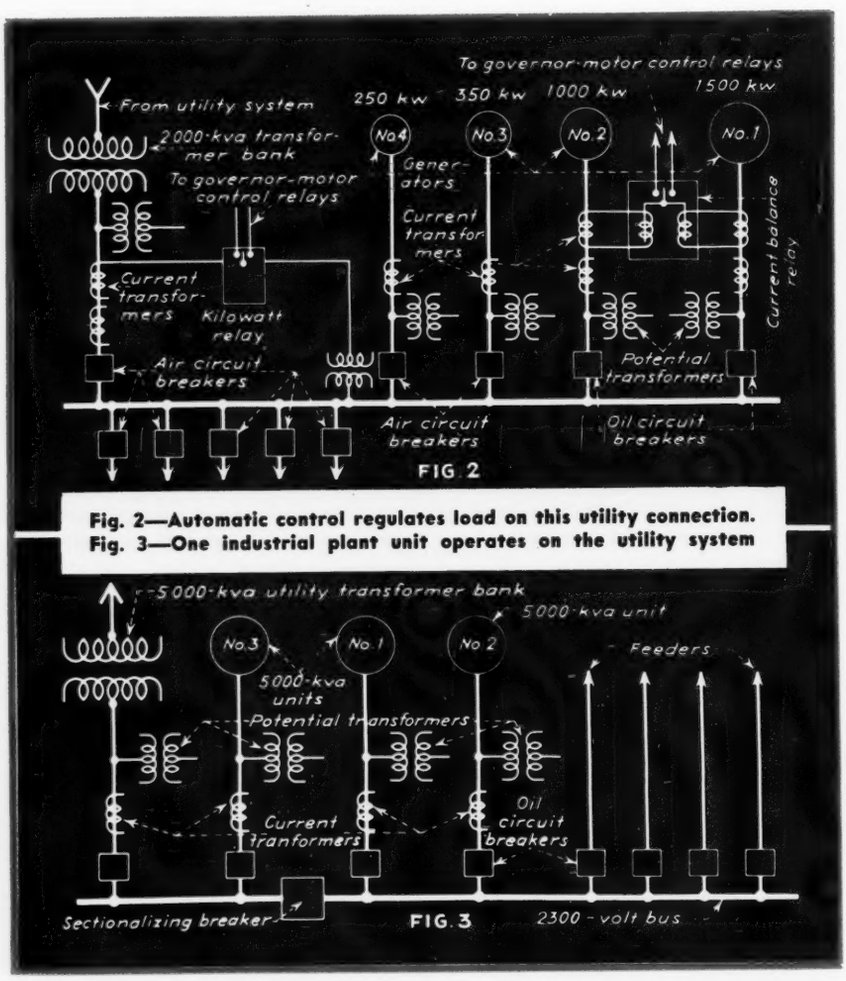


Fig. 2—Automatic control regulates load on this utility connection.
Fig. 3—One industrial plant unit operates on the utility system

utility with additional capacity and the mill with a standby unit that can be used in emergencies. Since the two systems normally run independently of each other, operation of both has been greatly simplified.

Pooling of industrial-plant generated power with a utility system is not new, but has been practiced in some cases for 20 or more years. The diagram, Fig. 4, shows such a plant. This plant has gone through a rather extensive development and improvement process during the last 25 years, until now it includes two hydroelectric plants and a steam-turbine-driven generator. One of the hydro plants has 2500-kva capacity in three units operating in parallel.

This plant and another with a single 1250-kva unit connect to the 2300-volt bus in the mill substation. From this bus the power goes through two 2000-kva banks of 2300/440-volt transformers to the 440-volt power bus, from which it is distributed to the load centers.

Part of the manufacturing process requires quantities of low-pressure steam which are supplied by a steam turbine driving a 500-kva, 440-volt alternator connected to the 440-volt bus. Load on this unit is controlled by pressure in the exhaust header. A 2000-kva bank of 33,000/440-volt transformers connects the local utility system to the 440-volt mill bus.

Load on the mill amounts to about 1800 kw and stays fairly constant. For several years the mill power plants ran independently of the utility system, which also operates several plants on the same river. When there was plenty of water the mill hydro plants generated an excess of power that was sold to the utility at dump rates. During dry periods water flow might get so low that the hydro unit could produce only about 15% of the mill requirement. This, with the output supplied by the steam-turbine unit, left a large block to be purchased.

As a result, the power bills varied from a monthly standby charge to a large amount, a condition not satisfactory to either party. This led to study by both interests to see how a cooperative effort would work out. Now, under a new contract, the power company has control over all power generation on the river and operates the plants to utilize the water most economically. The mill still operates its hydro plants but the power company directs the operators.

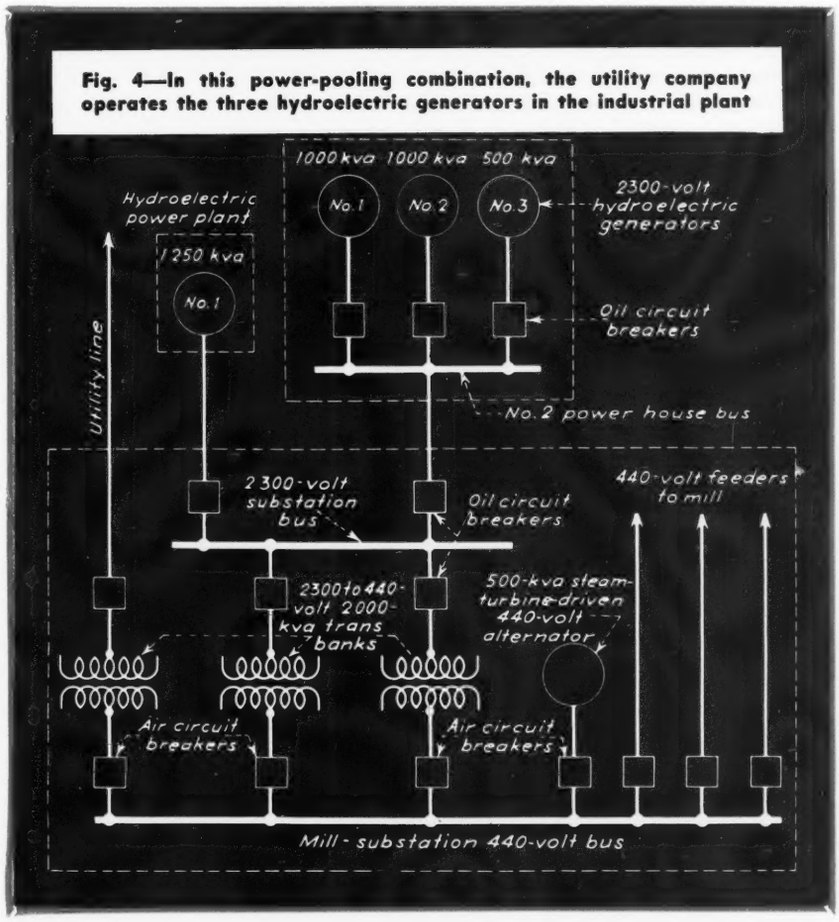


Fig. 4—In this power-pooling combination, the utility company operates the three hydroelectric generators in the industrial plant

The power company buys all power from mill hydro plants at a rate that includes a capacity charge, paid each month no matter how much or how little power the hydro plants produce. This payment amounts to, say, $1.50 per month for 2200-kw capacity. In addition these is a flat energy payment of, say, 3 mills per kwhr for all power from the hydro plants used by the mill. Any excess power from the mill hydro plants goes into the utility system and is paid for at dump rates.

The mill pays at prevailing rates for all power taken from the hydro plants and from the utility system. These rates include a demand charge about 7% higher than the capacity charge and an energy charge about 12% higher than the rate paid by the power company for power supplied from the mill hydro plants. The standby charge has been eliminated.

As this contract works out, during normal water flow and normal mill operation, power costs the mill practically nothing. During low-water, power costs to the mill are only about 50% of what they were when a large standby charge had to be paid. To balance the benefits to the mill the power company has control of all plants on the river and can arrange its operating schedule to utilize the water most economically and to generate the maximum kilowatt-hours.

FREQUENCY CHANGER USED

Where there is a difference in frequency, a frequency changer must be used to make the tie between the two systems. In one case, a municipal power plant maintained a considerable block of standby capacity for supplying power to storm-water pumps. This capacity, needed only infrequently, could be used by the local utility. As one system operated at 25 and the other at 60 cycles, a frequency changer was required.

This problem was solved in the secondhand market where a 7500-kw 35-yr old unit in good condition was located. After some slight alterations by the manufacturer of the unit, it was installed. This connection made available a block of power capacity that would otherwise be idle most of the time. In this case the voltages of the frequency changer matched those of the systems. Where they do not it may be possible to change the winding connections of the machines.

2 HOW TO POOL

Automatic Load Control

OPERATING an industrial power plant in parallel with a utility system presents a number of technical problems for the isolated-plant operator. These depend on type and size of plant generating units, prime-mover speed-regulation characteristics, excess capacity available, the isolated plant's location and job on the system, and other factors. One basic and immediate problem is load division between isolated plant and utility system and between units in the isolated plant.

After the plant has been synchronized and connected to the utility system, the operator must see that the plant performs according to a specified schedule if manual control is used or else he must provide automatic control. Under pooling conditions, the situation differs from that existing when the plant operates alone. In the latter case, if units are similar, operation in parallel is relatively simple; the machines require little attention even when load swings through a wide range. If frequency varies a fraction of a cycle either side of the required value it makes little difference. However, when the plant is connected to a utility system this same small frequency variation might overload the isolated plant or dump its load on the utility.

SYSTEM LOAD CONTROL

If isolated-plant prime-mover governors are properly adjusted and function correctly, there should be little difficulty keeping in parallel with the utility system provided the latter's frequency is held constant. Under these conditions, if isolated-plant load increases, its machines will tend to slow down and reject load to the utility system practically in proportion to the load increase. On the other hand, if industrial-plant load decreases, its power-generating units tend to increase in speed and pick up load from the utility system.

As a result of these characteristics an industrial plant, after being connected to a utility system and assigned a certain total load, will hold it, no matter how load may change in the industrial plant if the utility frequency remains constant. But this frequency generally does not remain fixed even when over a period of a day, the frequency averages up to give correct time. During this period the frequency has been slightly high at times and slightly low at others. Because of this and other factors the isolated-plant operator may have to adjust the governors at infrequent intervals to make the units take more or less load.

We have just discussed the simplest of load schedules under ideal conditions. Many factors complicate the problem and make the correct loading of an interconnected industrial power plant more difficult. The operator must pay close attention to loading, especially if manual control is used.

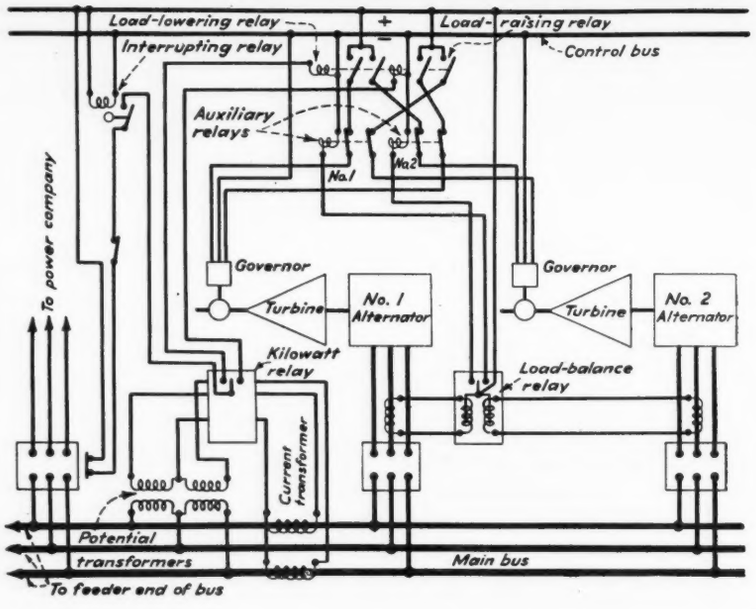
Flow control of wattless current (reactive kva) presents another important problem in operating two plants in parallel. Voltage adjustment determines how much of the reactive kva each system will supply. If the voltage of the isolated plant equals that of the utility system at the point where they are tied together, then the power factor of each will be practically the same and each will supply reactive kva in proportion to their kilowatt loads.

Voltage may be quite unstable on some parts of a large system; for example, on the end of a long line supplying a fluctuating load. If the isolated plant were tied to a utility system at such a point it would be difficult for it to supply a fixed percentage of the reactive kva with manual control.

BACKPRESSURE CONTROL

The foregoing has been based on the assumption that there are no restrictions on the steam end of the isolated plant and that at least some of the units operate condensing. Now consider a plant with one backpressure-turbine-driven generator, where demand for low-pressure steam always exceeds turbine exhaust. Additional power can be generated economically up to the limit of demand for exhaust steam. If such a plant were tied into a utility system the latter could take excess power above that required for the manufacturing load simply by governing the turbine by backpressure. As the demand for exhaust steam increases, pressure in the exhaust line will decrease. This will react on the gover-

Fig. 1 — Automatic control maintains constant load on the isolated plant and correct load division between the two generating units



Keeps Power Systems in Step

nor to admit more steam to the turbine, making it tend to increase its speed. Because it is tied into the utility system, the generator picks up kilowatt load comparable to the increased power developed by the turbine, when the admission valves open to supply steam necessary to restore backpressure to normal.

A generator operating under these conditions may have some excess capacity that can be utilized to absorb some of the reactive kva of the utility system, provided the generator field coils and exciter have sufficient capacity. With manual control the field excitation can be adjusted so that the generator will be fully loaded during maximum sustained demand for low-pressure steam. Then when the low-pressure-steam demand is less than normal the generator will still remain well loaded, because as the power load falls off with a decrease in low-pressure-steam demand, generator voltage will increase and its reactive kva load will also increase to maintain constant voltage. As a result the generator will remain fairly well loaded after once being adjusted for average load conditions.

Automatic control is available to maintain almost any load schedule with little attention from the operator. One such an arrangement is shown in Fig. 2. Assume that this unit operates under conditions such that the turbine may be loaded economically. By connecting a kilowatt relay as shown it can be set to maintain full load on the unit automatically. At this load the relay-moving contact remains in a central position, as in the figure.

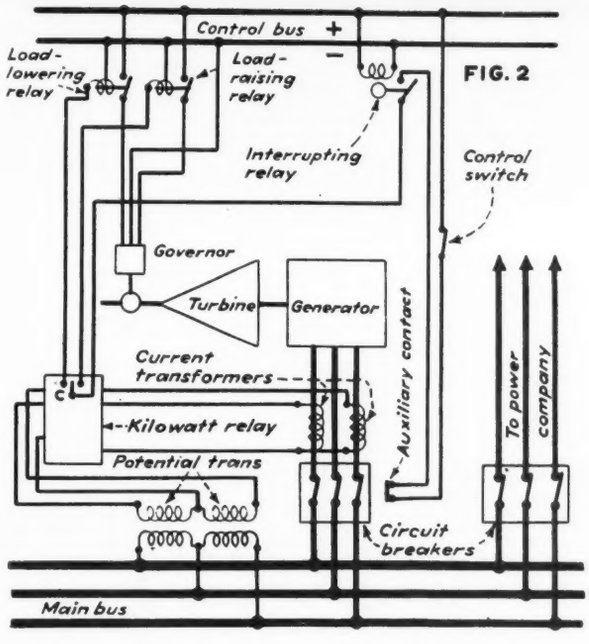
Stationary contacts on the kilowatt relay connect to load-raising and load-lowering relay coils, the contacts of which are in the governor-motor circuit. To stabilize the system, an interrupting relay has its contacts connected in series with the raising and lowering relay coils through contact *C* of the kilowatt relay. During a load adjustment the interrupter allows the governor motor to operate, say three seconds out of every twelve, to prevent over- or under-adjusting the governor and thus to eliminate hunting between isolated plant and utility system.

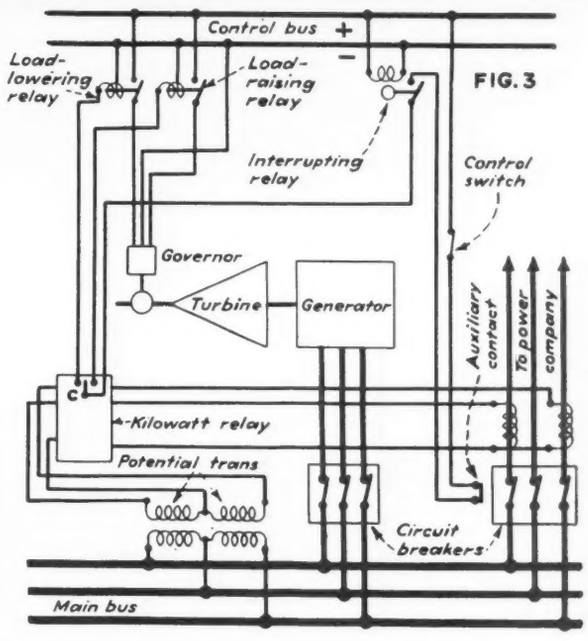
When power is taken from the utility company, almost the same control arrangement, Fig. 2, may be used to assign a certain base load to the utility and let the isolated plant take the remainder of the factory load. To do this the current transformers are put in the utility feeder, as in Fig. 3. With this arrangement, any change in the power flow to the plant above or below a specified amount causes the power-relay contacts to close. This makes the governor increase or reduce the load on the turbine to keep a nearly constant kilowatt load on the incoming line.

Interchange contracts generally call for a power factor of not less than a specified value. Power factor is maintained by adjusting the generator field rheostat, which generally can be done satisfactorily manually.

It may be desirable in some installations to hold constant load on the power plant at one time and on the utility feeder at another. This can be done by installing two sets of cur-

Fig. 2 — Automatic control holds constant load on power-generating units and lets the utility supply the remainder
Fig. 3 — Load on the utility connection held constant by automatic control with the isolated plant taking the peaks





rent transformers, one as in Fig. 2 and the other as in Fig. 3. Then by a suitable switch either set of transformers can be connected to the kilowatt relay and the loading controlled accordingly. By selecting two sets of transformers with the proper ratios, the load on the generators may be made different from that held on the utility feeder by merely throwing the current-transformer switch to one position or the other.

UNITS OPERATED IN PARALLEL

Instead of a single-machine plant, Fig. 2 and 3, two or more units may be installed. This requires keeping the plant loaded to meet a given schedule and dividing the load properly between the various units. To do this job manually requires close attention by the operator, but it can also be done automatically by the hookup of Fig. 1, page 76. This provides for maintaining a given load on the generating plant. It is necessary to connect the kilowatt relay transformers to the busbars between the generator bus section and the part to which the utility line and industrial plant feeders connect.

With the connection of Fig. 1, all power from the two generators flows through the current transformers; therefore the kilowatt relay is responsive to the total output of the isolated plant. If the control is adjusted to maintain full load continuously the plant will supply all the industrial-plant load, and any excess up to full load on the generators will be delivered to the utility system. If the industrial-plant load exceeds the isolated-plant capacity for which the control is set, the deficiency will be supplied from the utility system.

In Fig. 1 the kilowatt, load-raising, load-lowering and interrupting relays perform the same functions as in Fig. 2 except that these are connected to act simultaneously on two units in parallel. The kilowatt relay responds only to the total kilowatts delivered from the isolated plant. If something should happen to cause one machine to be overloaded and the other underloaded, the kilowatt relay will not be affected as long as the total kilowatts delivered by the machines total up to the relay setting.

LOAD DIVISION

To divide the load properly between the two machines a current-balance relay is added. This has two coils connected to a current transformer in one lead of each generator. The magnetic pull of these coils acts on a beam which carries a contact. If the pull on the right-hand coil exceeds that of the left-hand coil the contact will close to the right. A reverse over-balance of the coils closes the contact to the left.

Assume that No. 1 generator takes more than its share of the load. This will cause the current-balance relay to close its left-hand contact and energize the coil of auxiliary relay No. 1, which will open its contacts. This opens the load-lowering circuit to No. 2 turbine governor and the load-raising circuit to turbine No. 1. Now when the kilowatt relay acts to increase the load only unit No. 2 can respond. Likewise, if the kilowatt relay acts to lower the load, only unit No. 1 is affected, until the loads on the two units are again brought into proper balance, when the balance-relay contact opens. The reverse takes place if machine No. 2 takes more than its share of the load.

POWER-FACTOR CONTROL

This control method may also be used to deliver a given kilowatt load to the utility system or to take a given kilowatt load into the isolated plant from the utility.

In all these control methods the power factor of the isolated-plant load is controlled by manually adjusting the generator field rheostats. This can be done automatically with a voltage regulator. Many special problems are encountered in operating isolated plants in parallel with utility systems. The foregoing, however, gives a general idea of some of the ways they may be solved automatically by control arrangements that are now doing the job and that have been tested by long experience.

Correct Electrical Protection Makes Interchange Safe

WHEN THE POWER-GENERATING capacity of a system is increased, either by adding generating units or by tying into another system, protection of equipment and circuits against overload, short circuits, grounds and other faults increase in importance. For example, protection adequate for an isolated power plant may not be sufficient if the plant is connected with another isolated plant or into a large network through a heavy tie line. Therefore if the engineers of an industrial plant plan interconnecting their plant with another or with a utility system they must determine if circuit breakers and relays are adequate for the new conditions.

A circuit breaker is designed to interrupt a given current under specific conditions. To do this job properly it must have a brain, the function of protective relays. Many breakers for low-voltage circuits, particularly direct-current, contain the equivalent of protective relays that cause them to open the circuit on overload, reverse power or other faulty conditions. On alternating-current circuits, especially on the higher voltages, the protective-relay system is separate from the circuit breaker. This permits complete isolation of high voltage from the switchboard, and the relay system can be designed and installed to operate independently of the circuit breaker.

Fig. 1 shows a simple relay and tripping system which opens a circuit breaker during an overload. This

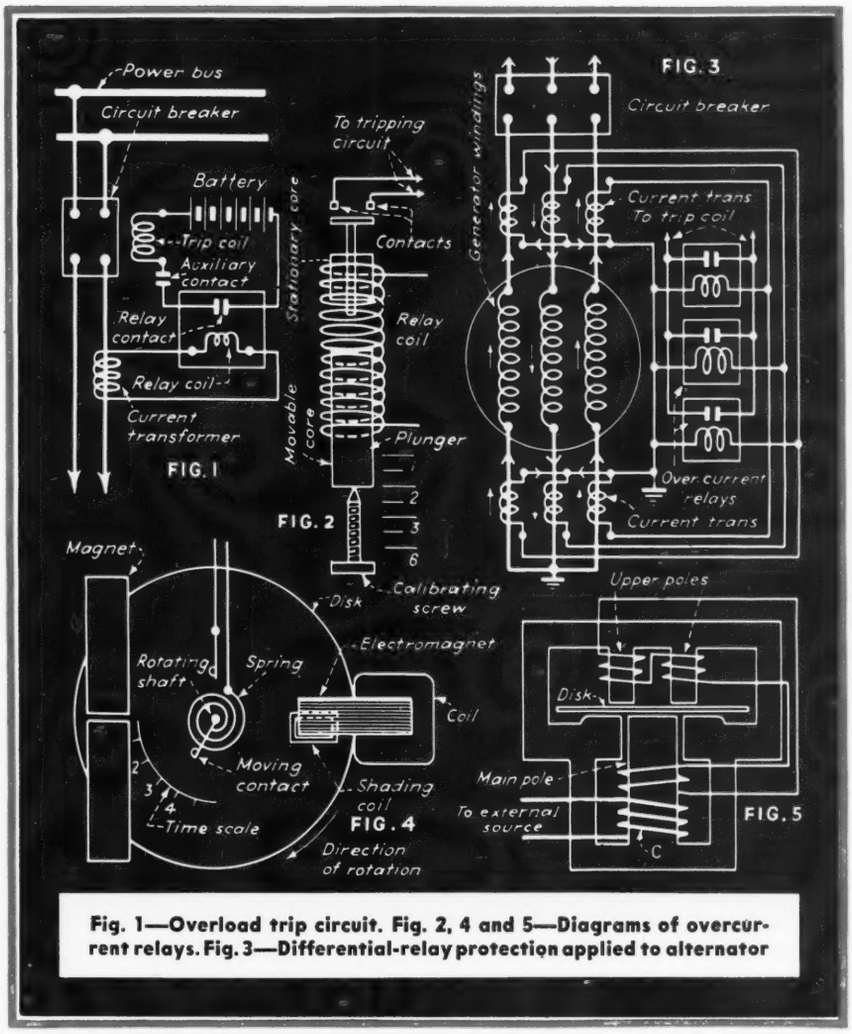


Fig. 1—Overload trip circuit. Fig. 2, 4 and 5—Diagrams of overcurrent relays. Fig. 3—Differential-relay protection applied to alternator

includes an overcurrent relay with its coil connected to a current transformer. The relay contacts are in series with the circuit-breaker trip coil, an auxiliary switch and a storage battery or other source of power for energizing the coil to trip the breaker. When an overload occurs, the current in the relay coil reaches a value that closes its contacts to complete the trip-coil circuit. When the circuit breaker trips out it opens the auxiliary switch to interrupt the trip-coil circuit, relieving the relay contacts of the job of breaking that circuit. Therefore, the relay contacts can be made much smaller than if they had to break the circuit.

Protective devices include overcurrent, under- or over-voltage, power, directional, pilot-wire, differential relays and others. Pilot-wire and differential relays are really systems of grouping rather than specific units.

Overcurrent or overload relays are most frequently used for protection of circuits and equipment against overloads, connected in the circuit individually or grouped in protective systems.

One of the simplest forms of overcurrent relays is the plunger, shown diagramatically in Fig. 2. It consists of a movable iron plunger below a stationary iron core in a solenoid coil. With normal current flowing in the coil the magnetic pull between the two cores is not sufficient to lift the movable one. When the current in the coil exceeds a predetermined amount the lower plunger moves up to the fixed one and the trip-coil-circuit contacts close to trip the circuit breaker, as explained in Fig. 1.

The relay, Fig. 2, closes its contacts almost instantaneously, but the time required to close the contacts can be increased by adding a bellows or oil dashpot. This relay has been developed in several improved forms, but none gives the characteristics desirable in a highly accurate and reliable relaying system. This has led to the development of the induction relay.

An induction relay is built on the principle of an induction watthour meter and contains all its refinement of construction and accuracy. Fig. 5 shows the magnetic structure and the electric circuits for one design of an induction overcurrent relay. The main coil *C* connects to a current transformer, as in Fig. 1. On the main pole with this coil a secondary coil connects in series with two coils on the upper poles. Transformer action of the main coil induces current in the secondary coils proportional to the load current in the current-transformer primary.

Between the upper and main poles, Fig. 5, an aluminum disk is supported on a vertical shaft running in jewel bearings, similar to those used in a watthour meter.

Fig. 4 is an elementary diagram looking down on the relay disk of another design of induction relay. The coils and electromagnetic system are shown on the right-hand edge of the disk. Instead of the disk rotating freely as in a watthour meter it is normally held by a spiral spring that also holds the contacts open.

The alternating magnetic flux threading through the disk induces eddy currents in it. These currents react with the magnetic flux to produce a turning effort on the disk that is opposed by the spiral spring. When the load current of the current-transformer primary exceeds a safe value the torque produced in the relay disk exceeds the restraining action of the spring and the disk rotates to close its contact in the trip-coil circuit.

The time required by the disk to close the contacts is controlled by two permanent damping magnets on the right-hand edge of the disk. When the disk starts to rotate, it cuts the flux between the poles of the permanent magnets to produce eddy currents that react on the magnetic flux to retard its rotation.

RELAY CHARACTERISTICS

Relays of this type have an *inverse time characteristic.* This means that the relay operates slowly on small overload-current values and faster on higher values. For example, on a 300% overload current it may require six seconds for the relay contacts to close. At 500% overload the contacts will close in about four seconds and on a dead short circuit the contact-closing time will be about 1.25 seconds. These times vary over wide ranges depending upon the relay design and are adjustable. Overcurrent relays are also available that close in a definite time, such as two seconds, irrespective of the overload.

Voltage relays may be built on the same principle as the current relay. The chief difference is that in one

the main coil is wound to operate on a current transformer and in the other the main coil connects to a voltage transformer at 115 volts. Power relays resemble current relays except that in power relays the main pole carries a coil connected to a voltage transformer, and the upper poles have coils connected to a current transformer, much like the coil arrangement in a watthour meter. One of the purposes of these relays is to trip out a circuit breaker when power flow reverses in a circuit. In such cases the direction of current flow through the current coils is reversed relative to the current in the voltage coil. This causes the direction in which the disk rotates to reverse and close the contacts on the relay to trip the breaker.

Modifications of current, voltage and power relays have been developed in many forms for protection of equipment and circuits under practically every condition. Overcurrent relays grouped to protect a 3-phase generator against overload form one of the simplest protective schemes. The same arrangement can also be used on the input end of a feeder for overload and short-circuit protection. When applied to generators it gives protection to the machine against external overload from any cause, but does not protect the machine against an internal fault, such as a ground in the windings.

GENERATOR PROTECTION

Several methods are available for protection of a generator against faults within its winding. One of these is known as differential protection, Fig. 3. In this system a current transformer connects to both leads of each phase winding outside the generator. Each pair of phase transformers is connected in series, with an overcurrent relay across their leads. As long as the current is the same in both leads of a phase winding, current circulates freely through each pair of transformers. If a fault occurs in one or more of the machine windings, current flow in the two ends of the phase windings becomes unbalanced. Under these conditions current in the two transformers in the faulted phase will not be the same and the difference will flow through the relay coil. This relay then closes its contacts and trips the machine off the system. The relays are designed to close their contacts almost instantaneously to trip the machine off the system quickly and keep the damage to windings and to other parts at a minimum.

Many different arrangements of differential-relay protection have been developed but that in Fig. 3 gives a general idea of the operation of one design. This system is also applied to the protection of transformer banks, large motors and parts of circuits. Pilot-wire relay protection, Fig. 7, is a form of differential relaying for protecting power lines.

If a substation or load-center bus connects to a powerhouse bus by two or more parallel feeders, Fig. 6, a short circuit occurring on a feeder, as at *A*, will have power fed into it directly from the powerhouse busbars and also over the good feeders to the substation and back into the fault. With simple overcurrent time-delay protection both feeders are likely to be disconnected before the fault is cleared, causing complete interruption of service.

To disconnect the faulty feeder without interfering with operation of other lines, a system of pilot-wire relay protection, Fig. 7, may be used. As long as power flows in one direction in the feeder, current flows through the current transformers as indicated by the arrows. Should a fault occur at *A*, then power reverses through the right-hand transformers on this feeder. This causes the current transformers at each end of the conductor to oppose each other. Their current then flows through the relay coils and trips the circuit breakers to disconnect the feeder at both ends.

RELAY COMBINATIONS

Overcurrent relays are also used with the pilot-wire system. The overcurrent relays have a time delay, while the pilot-wire relays are instantaneous trips. Therefore the pilot-wire relays trip the faulty feeder off the system before the overcurrent relays on the other feeders can close their contacts and trip their breakers. In this way the faulty circuit is removed from the system without interrupting service.

The foregoing presents the basic principles of relaying and protective devices, a thorough understanding of which is essential to successful power pooling. The following article shows the application of these principles.

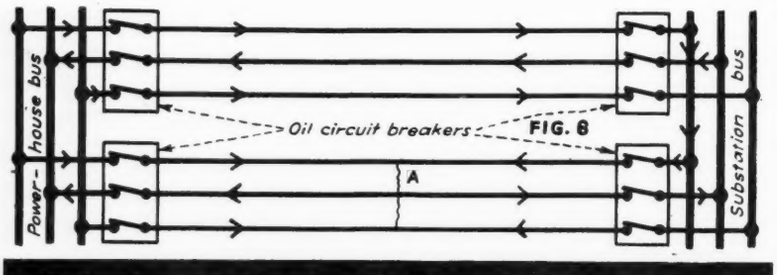
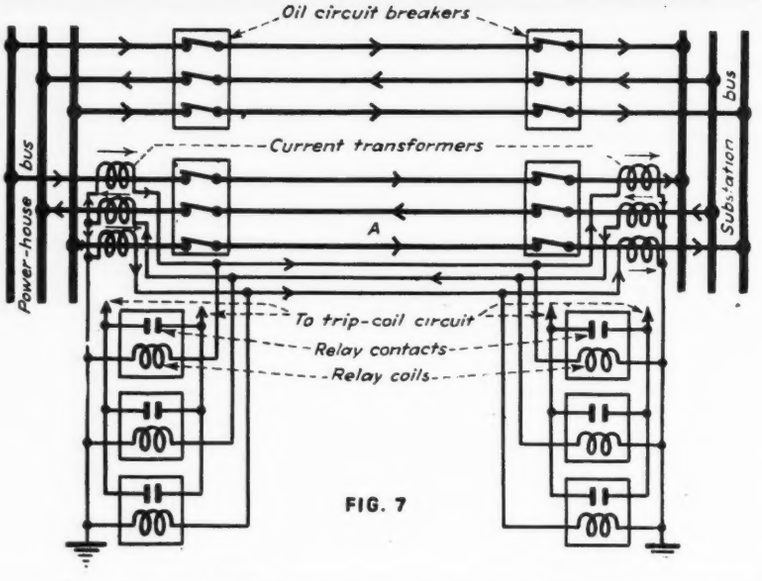


Fig. 6 — Power will flow over both feeders to a fault, such as at *A*
Fig. 7 — Pilot-wire relays trip faulty feeders only off the system



Interconnection Puts More Load on Circuit Breakers

AN AIR-BREAK OR OIL-BREAK circuit breaker has to do two jobs when protecting a circuit. First, it must be capable of carrying full rated current at rated voltage. Second, the breaker must be able to interrupt the heaviest short-circuit current that may be encountered. It must do both without suffering either electrical or mechanical injury from the forces produced in its structure when clearing the fault. Frequently only the first is given consideration and the latter neglected. This has led to breakers failing with disastrous results.

Air-break circuit breakers are generally used and have many advantages over oil circuit breakers for indoor service and for circuit voltages up to 600 volts ac and 750 volts dc. Oil circuit breakers are not commonly used for less than 600 volts ac unless atmospheric conditions are such as to require the inclosing of the breaker's current-carrying parts. Above 600 volts ac air-break circuit breakers of special design are available for as high as 15-kv circuits. Oil-break and compressed-air breakers are built to open high-voltage power circuits.

CIRCUIT-BREAKER RATING

Circuit breakers are rated according to voltage, continuous current-carrying capacity, short-time current-carrying capacity and interrupting ability. They are built for indoor and outdoor service. Because outdoor breakers must be weatherproof and have greater insulation they occupy more space and cost more than indoor designs.

Current flowing into a circuit fault, which the circuit breaker must interrupt, depends upon several factors, some of which are: The size of the circuit wires and how far the fault is from the source or sources of power; whether the fault is a phase-to-phase or phase-to-ground short circuit and the ohmic resistance of the fault; the connected generator capacity and its characteristics; and motors forming the load and their characteristics.

Unfortunately these factors may vary over a wide range and the system so change that circuit breakers which were once capable of interrupting any fault occurring on the system may become entirely inadequate. For example, when plant capacity is small the circuit breakers may have ample interrupting ability, but when capacity is greatly expanded by the addition of generators and synchronous motors, or by interconnecting with a utility system, fault currents may become too large for the breakers and they will explode or fail in other ways. This is probably best illustrated by an incident which occurred in one plant.

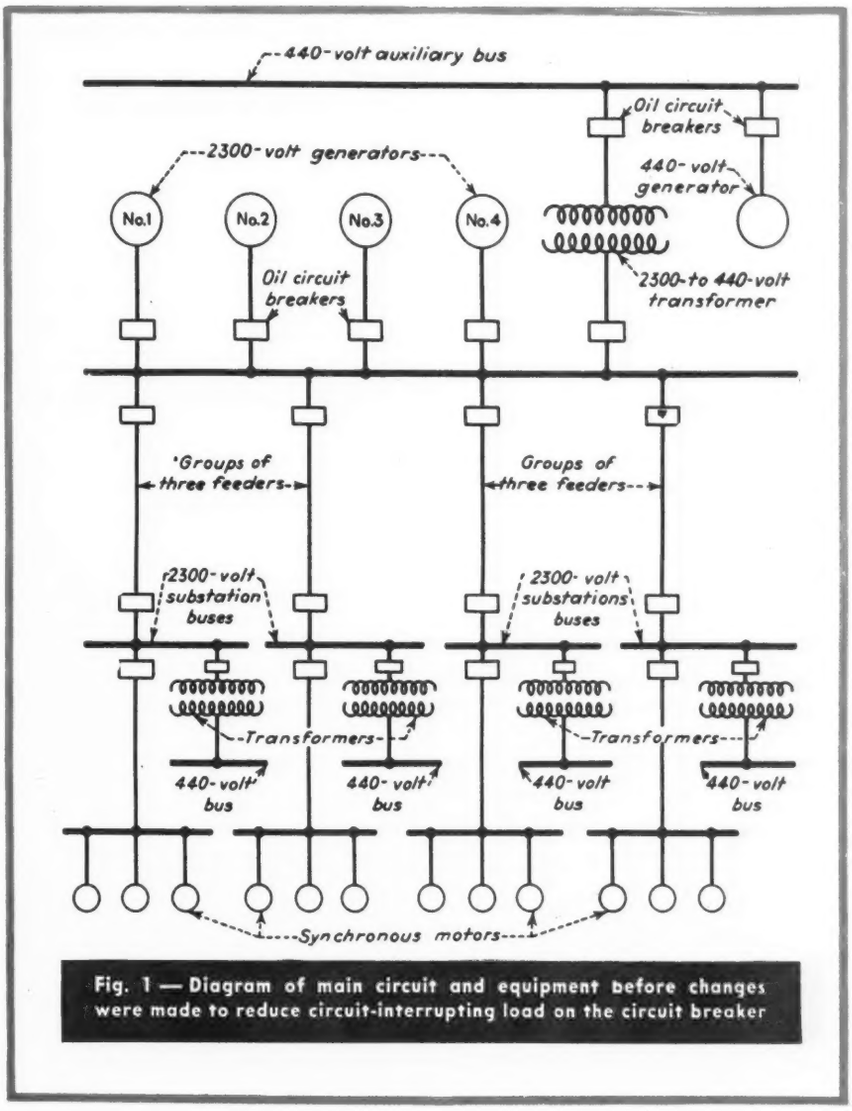


Fig. 1 — Diagram of main circuit and equipment before changes were made to reduce circuit-interrupting load on the circuit breaker

When the plant was first installed about 20 years ago it had two generating units of about 2500 kva capacity. Plant size was increased until it had about 25,000 kva installed capacity in four 2300-volt units connected to a main bus and a 440-volt machine connected to a bus from which the power-house auxiliary motors are supplied. Four groups of three feeders each connect the main bus in each of four substations. From

2 HOW TO POOL

each substation power is distributed at 2300 volts to a load-center bus, from which several large synchronous motors operate. Power is also taken through a bank of transformers and distributed at 440 volts to induction and synchronous motors. In addition to these loads there is the usual 220- and 110-volt distribution for small motors and lighting.

About one-half of the total load on the plant is in synchronnous motors. When a fault occurs on the system these are practically equivalent to the same amount of generating capacity. With these motors on the system and the large generator capacity in the power house, approximately 300,000 kva could be fed into a short circuit. When a 50,000-kva circuit breaker was called upon to interrupt six times its rated capacity it just exploded, sometimes causing serious interruption to the whole power system.

HOW PROBLEM WAS SOLVED

One solution to this problem would have been to install circuit breakers of sufficient interrupting capacity to handle the heavy short-circuit currents. This would have been expensive and involved a difficult reconstruction job. Even if the larger switches successfully ruptured the fault currents, the latter would subject the other electrical structures to heavy mechanical forces that might cause them to fail. It was therefore decided to sectionalize the system and install current-limit reactors, as indicated in Fig. 2.

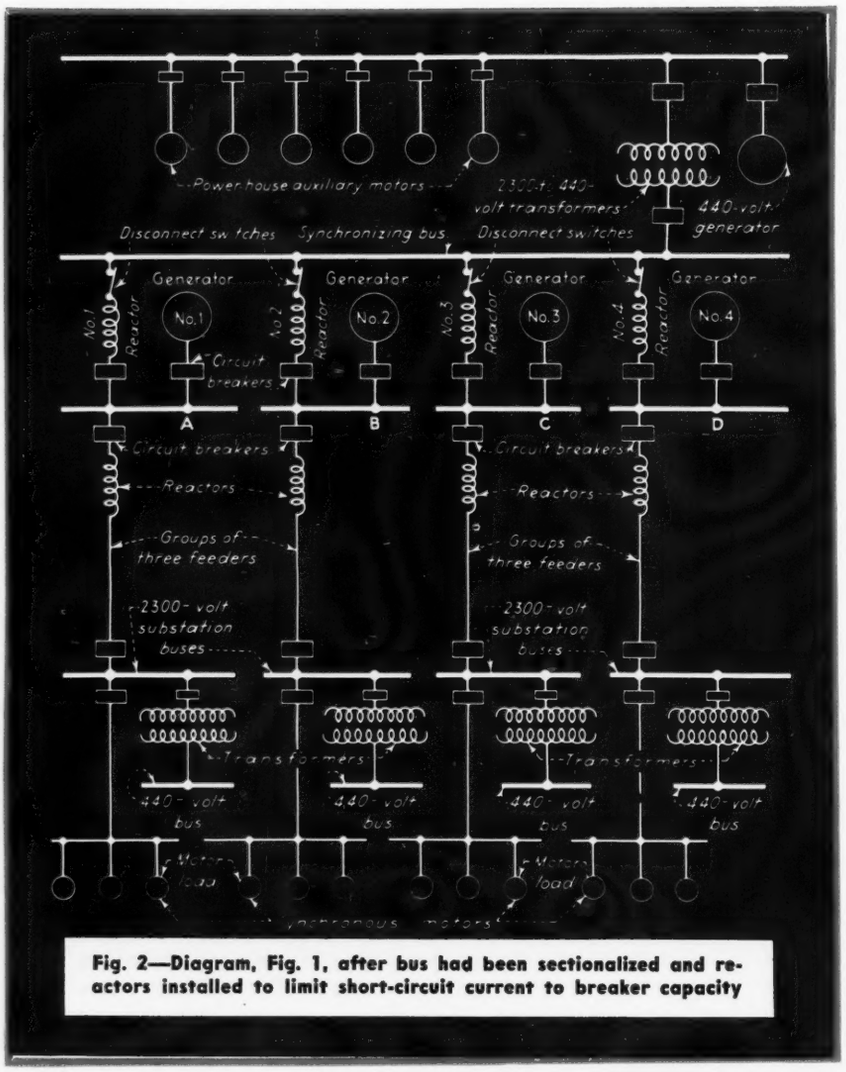


Fig. 2—Diagram, Fig. 1, after bus had been sectionalized and reactors installed to limit short-circuit current to breaker capacity

The generator bus was cut in four sections, with a generator connected to each section. A synchronizing bus was installed, to which each main bus section was connected through a circuit breaker, a reactor and disconnect switch. Reactors were also installed in each 2300-volt feeder. In addition to these changes, each of the 2300-volt feeders was protected by pilot-wire relays so that if a fault occurred on any one of a group of three feeders, the faulty feeder would be disconnected instantaneously at both ends before the circuit breakers on the two good feeders could open (see Fig. 7, page 80). In this way faulty circuits were quickly removed from the system without interfering with the operation of other equipment.

If each generator has sufficient capacity to supply the load on its section of the bus, then the circuit breaker between each bus section can be opened and the plant operated as four separate units. In this way only one generator would feed into a fault, further relieving the circuit breakers. When operating this way there is always the danger that the turbine or the generator will be tripped off and temporarily leave its section of the plant without power.

Another arrangement might have been used in this plant. This would have involved providing connections between the substation buses, tying these together and operating the generators as separate units in the powerhouse. Then, if a generator tripped off in the powerhouse its substation would be fed from other substations.

Before the change was made in this installation, if a heavy fault occurred on the system the voltage would drop so low that the powerhouse auxiliary motors would trip off the system and shut the plant down. With the new arrangement the voltage holds practically constant and has eliminated all trouble from this cause.

Protection of the generators with differential relays also adds to plant reliability. With this system the relays trip the generators off the bus only if trouble occurs in their stator windings (see Fig. 3, page 79). The changes in this system illustrate use of most of the devices that can be applied to reduce the fault current that a circuit breaker must interrupt.

Where low-voltage air circuit breakers are used it may be possible to use them in *cascade*, that is, in series. In this arrangement the main breaker has sufficient capacity to interrupt the heaviest fault that can occur on the system and is set to trip on a current slightly below the maximum that can be handled by the smaller breakers. Normally the main breaker is not opened by a fault, as the fault current remains within the limits of the smaller breakers. However if a severe short-circuit develops, the main breaker trips out and saves the smaller breaker. On 440-volt systems, overloaded oil switches have been replaced by air-break circuit breakers of ample capacity to interrupt the short-circuit currents.

Power Pooling Introduces New Metering Problems

IN ANY POWER POOL between industrial and utility plants, accurate and dependable meters are an absolute necessity. Large blocks of power moving betwen the two must be measured, so that operations can be controlled and costs of each party determined. Here are some simple facts about meters, both kilowatt-hour and maximum-demand, which will help the power engineer to understand metering and to apply meters effectively.

Most power men are familiar with the kilowatt-hour meter which records the kilowatt-hours of energy transmitted through a circuit in a given time. It operates like an extremely accurately constructed motor and runs at a speed directly proportional to the kilowatt load transmitted in the circuit to which the meter is connected.

Maximum-demand meters give an average value of the kilowatt load for a given period, such as 5, 10, 15, 30 or 60 min, 15 min being a commonly used interval. For example, assume a 15-min time interval in which the kilowatt-hour meter recorded 150 kwhr. Then, the average kilowatt load for this period would have to be 150x4 = 600 kw maximum demand. Maximum-demand meters are either built as part of a kilowatt-hour meter or as a separate meter.

Fig. 1 shows one simple arrangement. On the same dial with the kilowatt-hour register is a scale for the maximum-demand indicator. During the time interval of maximum demand, the kilowatt-hour meter moves the demand pointer across its scale at a rate proportional to the kilowatt load. At the end of the time interval, a synchronous-motor-driven clock mechanism releases the pointer-driving mechanism and it returns to zero leaving pointer where it is. If during the next, or any future interval the power consumed is less than that used in previous intervals the pointer will not move. If power consumed during some future interval exceeds that of previous periods, the pointer moves further along the scale. The pointer shows the highest maximum demand that occurs between readings. After the meter is read, the pointer is moved back to zero, ready to indicate the maximum demand during the next metering interval of time.

These meters are also built as individual units and operated by contacts opened and closed by rotation of the kilowatt-hour meter, as in Fig. 2. In this diagram only the electrical connections for the demand meter are shown.

Fig. 1 — Combination kilowatt-hour and demand meters. Fig. 2 — Diagram of demand meter. Fig. 3—Demand-meter on 15-min intervals

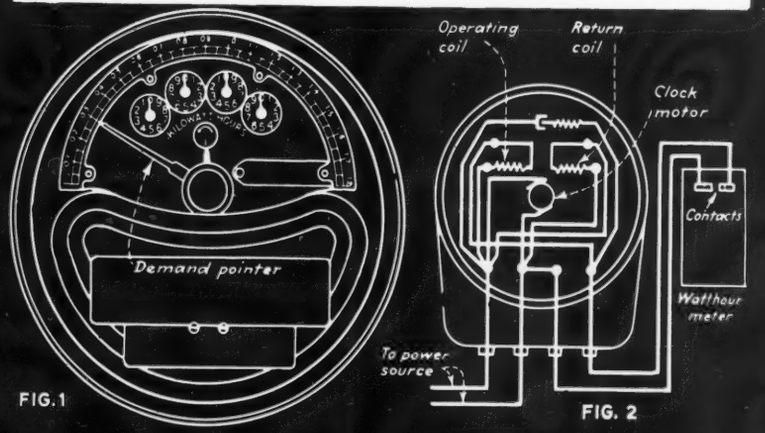


FIG. 1

FIG. 2

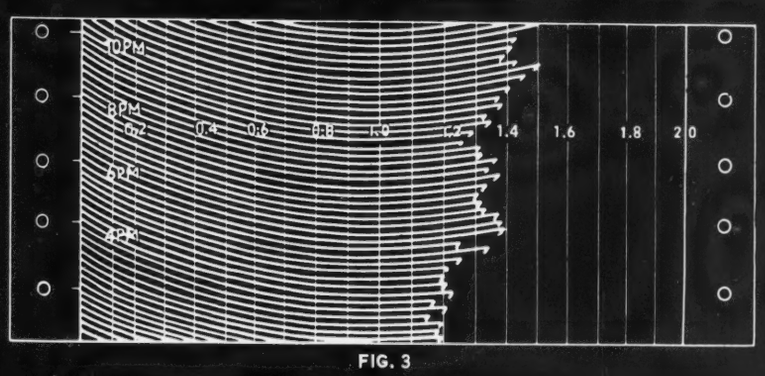


FIG. 3

RECORDING DEMAND METERS

Indicating demand meters show only the maximum demand that occurs during the period between meter readings, which may be once a month. If we want to know more about the maximum demand we use either a strip- or circular-chart recording meter. Strip charts are available that will give a continuous record for four months on a 15-min demand.

Recording demand graphs are similar to Fig. 3. During the time interval the pen moves across the chart in proportion to the kilowatt hours of energy transmitted. At the end of the interval, when the pen is tripped, it makes a small loop at the end of the record, as shown, to clearly indicate the end. The pen then lifts and returns to zero to record the demand for the next time interval.

The chart advances at a continuous rate of 1/16 in. per time interval, therefore, a record is obtained in the form of a series of curved lines. A curve connecting the tops of these lines shows how the demand varies during any given period. The record, Fig. 3, is for 15-min demand intervals

as indicated by 8 demand lines in each 2-hr period.

Where higher accuracy is required than is possible with an indicating or a recording demand meter and where the amount of power involved justifies the cost, a printing meter may be used.

Load power factor is an important consideration in all alternating-current power systems.

An alternating-current power load can be considered as being made up of two parts (components). A power component, kilowatts, and a reactive component, called reactive kilovolt-amperes. Reactive kilowatt-amperes are sometimes called kilovars, meaning kilovolt-amperes reactive. The kilovolt-ampere load on any alternating-current system equals the square root of the sum of the kilowatts squared and the kilovars squared, that is:

$$kilovolt\text{-}amperes = \sqrt{kilowatts^2 + kilovars^2}$$

METERING KILOVAR-HOURS

When power factor is an element in the rate paid for power the kilovar-hours are frequently metered along with the kilowatt-hours. A kilovar-hour meter differs from a kilowatt-hour meter only in the way it is connected into the circuit. Fig. 4 shows a kilowatt-hour meter connected to a 3-wire 3-phase circuit to record kilowatt hours. To simplify the connections potential transformers have been omitted as would be done on a 120- or 240-volt circuit. In Fig. 5 the same meter is connected to record kilovar-hours. The meter current coils are connected to their current transformers the same way in both diagrams. The only change is in the potential-coil connections.

In Fig. 4 these coils connect directly to the line whereas in Fig. 5 they connect to auto-transformers in such a way that at unity power factor the voltage impressed on the potential coils is 90 deg out of phase with the current in the meter current coils.

At unity power factor the reactive component is zero and because the voltage and current in the kilovar-hour meter are 90 deg out of phase the meter torque is zero and it does not register. At 0.707 power factor the reactive component equals the kilowatts, therefore the kilowatt- and kilovar-hour meters will record equal amounts. For other power factors the meter readings vary accordingly. Knowing the kilowatt-hours recorded for a given period and the kilovar-hours for the same period the kilovolt-ampere hours can be computed by the formula given previously. Dividing the kilowatt-hours by kilovolt-ampere hours gives the average power factor for the period of the meter readings.

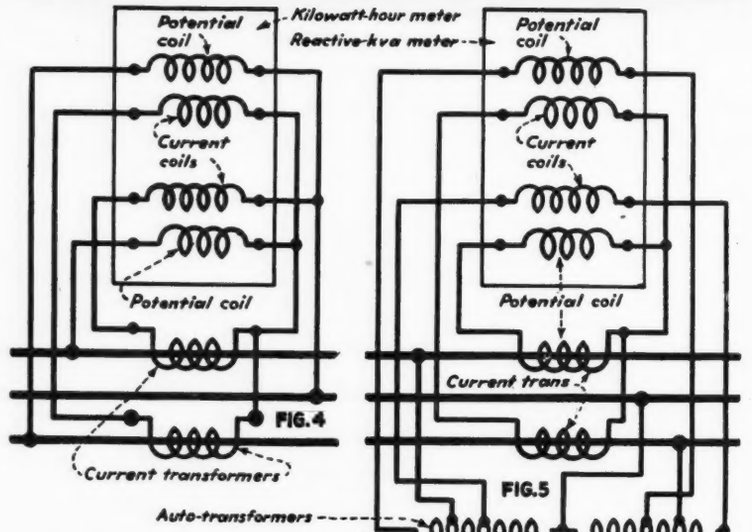
Kilowatt-hour and kilovar-hour meters are used in several ways, either individually or in combination. One combination of these meters includes a kilowatt-hour and a kilovar-hour meter provided with a maximum-demand recorder. These are all geared together in such a way that they record kilowatt-hours, reactive-kilovolt-ampere-hours, kw demand, and kva demand and also indicate the instantaneous power factor. From these records the engineer can compute the average power factor for any demand interval, the average power factor for the period between meter readings and the kilovolt-ampere hours for that period. This is generally more than is required on most metering jobs, but this metering combination indicates what can be done with modern meters.

Fig. 6 shows a section of a chart from a combination kilowatt and kilovolt-ampere demand recorder for a power factor of 0.70 (30-min intervals). The offset in the middle of each demand curve shows the 15 min-interval demand. This record was made on a constant load, therefore all the demand curves are the same length and the 15-min-interval demands all occur in the middle of the 30-min demand.

The kilowatt demand is recorded by the pen after it is released at the end of the kva-demand interval and is returning to zero. When the pen returns to a position that represents the kilowatt demand for that period it contacts the chart again and describes a small loop that indicates the kilowatt demand. After recording the kilowatt demand the pen again lifts clear of the chart and returns to zero to start again to record.

The kilowatt demand divided by the kilovolt-ampere demand for any interval gives the average power factor for that interval. In Fig. 6 the kva demand equals about 1.72 and the kw demand is 1.2; and the average pf for the interval is $1.2 \div 1.72 = 0.70$.

Fig. 4 — Diagram, kilowatt-hour meter. Fig. 5 — Diagram, kilovar-hour meter. Fig. 6 — Kilovolt-ampere and kilowatt-demand record



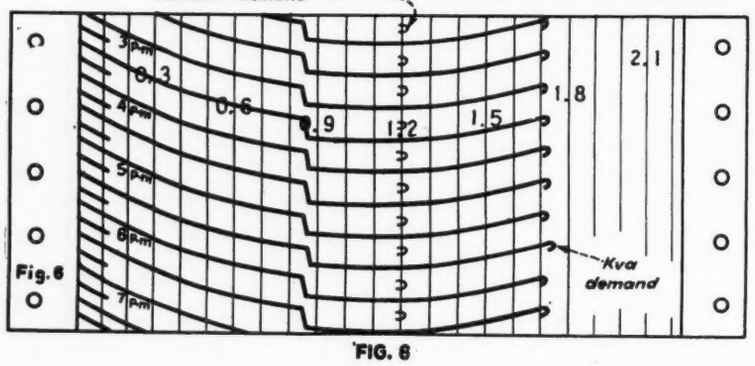
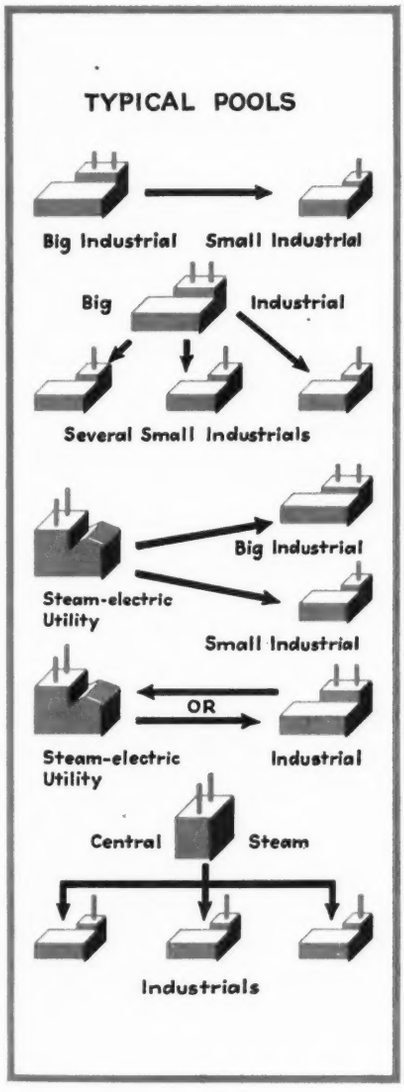


FIG. 6

Trading Steam Creates More Boiler Capacity

TOO OFTEN discussions of power supply look upon steam solely as a means of producing electricity. The error is obvious when one considers that American industry consumes 50% more steam for process and heating than do all the central stations for electrical generation.

Aside from district-steam systems, the typical steam pool rarely extends more than a few hundred feet—that is, from one plant to another alongside. For many years such arrangements served the requirements of peacetime economics by conferring dollar benefits on the parties to the typical steam exchange. The steam seller found an outlet for excess boiler capacity or waste fuel and also split his plant labor cost. The buyer of steam saved himself either the labor and fuel cost of operating a small and inefficient steam plant or the capital cost of buying new equipment. Offsetting these mutual advantages of steam exchange was always the considerable cost of piping connection.



POOLING STEAM FOR WAR

The wartime advantages of steam pooling spring, not from dollar savings, but from the creation of "new" boiler capacity without actually tapping the overworked capacity of the boiler manufacturers and plate and tube mills. Long connections are avoided, not for cost reasons, but because steel for piping and supports is scarce and must be conserved.

Both in peace and war the need for pooling arises from some departure from the normal balance wherein each plant has the proper steaming capacity to serve its own needs. The war is rapidly unbalancing the peacetime industrial steam situation. Every *new* war-production plant is a steam user. Many plants converting from civilian to war production will need far more steam than before because of the changed nature of the product or its increased quantity.

NEW STEAM SUPPLIES

These are the new steam *demands*. The new excess steam *supplies* will arise in the plant of the civilian-goods producer who cannot fully convert to war production. Unless he produces food, or some similar essential, his operations will be curtailed and he will find himself with some excess steaming capacity. A steam connection to a neighboring war-production plant may give him a market both for his excess boiler capacity and his engineering manpower.

Here are a few typical examples of steam pooling, with identification omitted for obvious reasons:

On the West Coast a large process plant *A* stands right across the street from a commercial laboratory *B* making important medical supplies for the armed forces. Plant *B* urgently needed moderate amounts of process steam at a closely controlled pressure of 130 psi, so *A* ran a 300-ft line under the road. The purchaser paid for the connection, including a recording flowmeter and accessories. Charge for the steam was actual cost plus a percentage for office expenses.

A large metal-working plant *A* in the East is next to a factory *B*, with a small and obsolete boiler plant. Boiler plant of *A* now serves both establishments with high thermal efficiency and with a single boiler-plant crew, thus conserving manpower.

STEAM-SHARING EXAMPLES

New England, where older industries are often highly concentrated in cities, contains many good examples of steam-sharing arrangements: such as the case of a steam-electric central station supplying a neighboring textile finishing plant, and a textile print works furnishing steam to a finishing plant a short distance away.

Both in peace and in war the exchange of steam between plants is frequently dictated by the availability of excess waste or byproduct fuel. Outstanding examples are found in the West Coast lumber mills whose huge output of sawdust and hog fuel generally far exceeds the fuel demands of the mills. That means either fuel or steam for sale. A case in point is a lumber mill in the state of Washington that furnishes steam to a local gas plant.

The difficulties and complications of a steam exchange increase in almost direct proportion to the distance over which the steam must be conveyed. For lack of steel for piping and supports, long connections now have little appeal, but American engineers will find hundreds of places where short connections will effectively combat the existing shortage of new boilers, will save fuel by permitting more efficient combined operations and will conserve the limited supply of trained engineering manpower.

PART

3

FUEL A KEY FACTOR

Fuel shortages must not cripple power output for war production. Engineers in oil-short areas can cooperate by converting; coal users can help producers and shippers by off-peak purchasing and emergency stockpiling. Here are the facts

Cooperation Will

WITHOUT FULL COOPERATION among government, producers, transportation agencies and consumers, fuel shortages may slow war production just when we're trying to throw every last ounce of effort into the fight. Here again it's "teamwork for victory". What shape must this teamwork take?

Diesel operators in the Middle West face new problems caused by tank-car shipments to the oil-hungry East. New England power men, dependent in many cases on water-borne coal as well as oil, must battle a double shortage threat. Labor scarcity in the Pacific Northwest threatens a coal-production deficit. And so it goes—the fuel problem affects every power engineer in the country. Each must do his part in its solution.

OIL-SHORTAGE AREAS

The major oil-shortage area lies along the Atlantic seaboard; the Middle West is affected to a lesser extent. Former difficulties caused by diversion of tankers to more essential services have been immeasurably increased by submarine attacks. Thus far the net result has been a drastic reduction in water-borne shipments which, in normal times, accounted for 95% of east-coast supplies. Last fall, increasing tank-car shipments to the East and building new pipelines seemed to promise a solution.

Although the railroads took a larger share of the burden than was thought possible, need for steel in direct war uses caused withholding of pipeline authorizations. Reduction in gasoline consumption and emergency transportation measures carried the danger areas through last winter without major trouble. But shipments have failed to match consumption and stocks have been drawn down. Even with the help of a 24-in. pipeline from Texas to Illinois, recently authorized and expected to operate this winter, the East Coast faces the need to operate this winter on something like two-thirds of normal supplies.

Both production and transportation facilities for natural gas are short; many gas-using areas (northwestern New York, western Pennsylvania and Kentucky, Kansas, Ohio, for example) face definite restrictions. There is little prospect that these conditions will improve in the future.

Power engineers in oil- and gas-short areas can cooperate in two ways. First, they must exhaust every possibility of conversion. Installing equipment to burn coal gives as much "fuel insurance" as it is possible to get in these days. Priorities for equipment needed to make the change can be secured if (1) shortage of oil or gas would interrupt vital war production, or (2) conversion would save a large quantity of oil. If changeover is physically possible (and it is in many plants if some ingenuity is employed) check your priority standing immediately and start work now. Remember that as the war enters the offensive phase, shipping problems will become more acute and that the oil situation thus shows no signs of early improvement. Even though your conversion is too late to affect this year's peak period, it may be even more improvement next year.

CONVERT INTELLIGENTLY

Carry this thought of an extended emergency into the selection of conversion equipment. Handling and firing devices should be as simple as possible to reduce load on manufacturing facilities and to speed fabrication and delivery. However, conditions may force operation of conversion equipment for several years and during this period operators may not have a choice of coal but may have to take what they can get. After the emergency has passed, ability to fire two fuels instead of one will be desirable. All these factors point to the need for sound engineering. Keep the installation simple but provide for the details necessary to flexible and economical operation, even though these may have to be added later.

Operators forced to continue burning oil or gas must, for their own protection as well as for the general welfare, make the best possible use of fuel allotted to them. This means higher boiler-room efficiency and most effective utilization of steam and power. In World War I fuel was allocated according to plant efficiency—it may happen again!

Last year, transportation stood out as the nub of the coal situation. This

Stave Off Fuel Shortages

year, production also represents a problem. With manufacturing industries, coke ovens and utilities using more coal than ever before and with the railroads, largest single coal consumers, rolling every piece of equipment they can find, estimates indicate consumption of more than 560,000,000 tons of bituminous this year and 60,000,000 tons of anthracite.

COAL-PRODUCTION RATE

As long as the producers get material to maintain and replace existing equipment and as long as necessary labor is available, bituminous mines can operate at a maximum rate of 12,000,000 tons weekly. This exceeds by a narrow margin the less than 11,000,000 tons per week needed to produce 560,000,000 tons in 1942. The margin looks even narrower when it is remembered that about 500,000 tons of it represents the output of high-cost difficult-to-work properties.

Here, then, is the first place the shoe pinches. To meet expected demands the mining industry must operate at nearly full capacity every week of the year. The margin is so small that dropping much below 11,000,000 tons per week for any substantial period would almost surely mean a loss on the year's total. To operate at full capacity, the producers must have orders and they must have some assurance that the coal will be shipped regularly, because storage capacity at mines is limited.

So we come to transportation. Like the mines, the railroads can probably swing the job if the load can be spread more evenly. In the past, carloadings have always hit a peak from mid-September to mid-November, when the three major bulk shipments, coal, iron ore, and grain, have been heaviest. Last year the load was spread somewhat over the summer months and carloadings went to a top of a little more than 900,000 per week as against estimates ranging from 940,000 to 1,050,000. New car building, higher speeds and quicker "turnaround" have barely kept pace with shipping increases and this fall the situation will again be tight.

Here, again, the shoe pinches. Coal shipments must be spread more evenly over the year and customers must allow more time margin so that specific shipments can be fitted into railroad operating schedules to make best use of every bit of rolling stock and motive power. Wherever possible, long hauls must be eliminated by use of nearby fuels.

The last six months have seen an intensive drive to ease the load on coal producers and the railroads. Consumers have been advised and urged to buy coal and store it. The goal for utilities and essential war industries is 90 to 120 days supply in storage; for other industries it is 60 to 90 days supply and for residential consumers it is a full winter's supply.

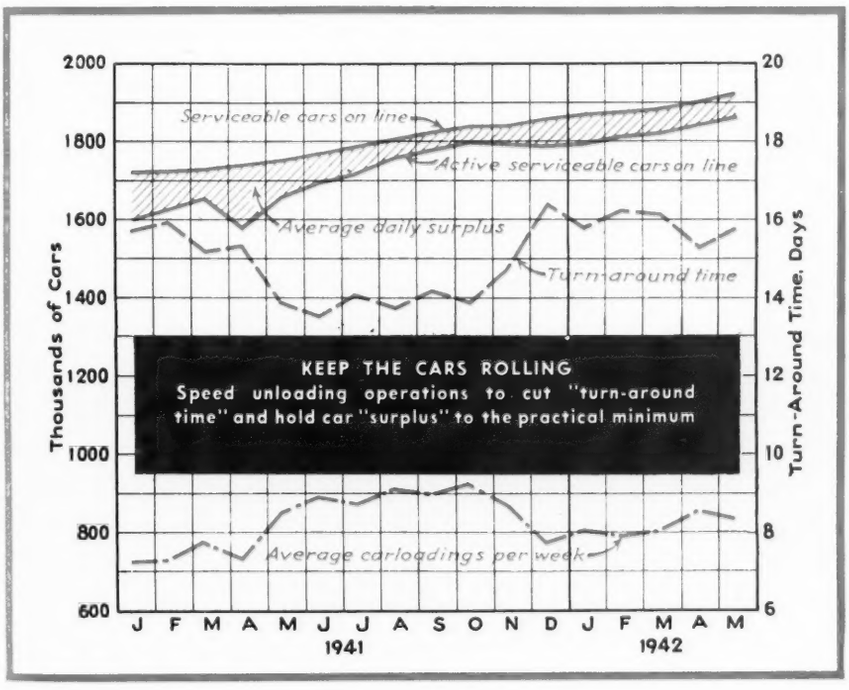
Current reports indicate that utility storage now runs more than 65% higher than at this time last year. Further proof of the effectiveness of the "buy now and store" campaign lies in the fact that production to date has slightly exceeded the necessary 11,000,000 tons weekly output.

TWO SORE SPOTS

At present two sore spots loom—New England, where ship sinkings have diverted normal coal shipments by water, and the Washington-Oregon area. Moving the 26,000,000 tons of bituminous New England needs may prove more than the roads can handle. On the record, this area may be as much as 3,000,000 tons short over the year, even allowing for increased shipments of anthracite, normally carried all-rail to New England. Manpower shortages may cause a deficit of 500,000 to 1,000,000 tons in Washington and Oregon.

The strategy of the storage campaign is obvious and so are its advantages to the consumer. Orders placed to build up stocks give the mines work for slack periods and permit the railroads to haul at most convenient off-peak times. The consumer has the solid satisfaction of knowing that the coal he needs is where it can be reached when wanted.

Power engineers can cooperate in several ways. They can place all orders, both for building the stockpile and for current consumption, with due regard for the problems of the coal producers and the railroads. As far as possible, place orders in off-peak months (late spring and early summer). Allow as much time for delivery as possible. Give as much leeway on size and analysis as practical. If you now use coal from distant points because of premium qualities, make the changes necessary to burn coal from nearby mines.



3 FUEL PROBLEMS

How to Make Emergency

TO COOPERATE in easing the fuel situation, most operators of coal-fired plants will store more fuel than every before; many operators of converted plants will store coal for the first time. To do the job they must know how to store coal safely and how to make best use of available handling and storage facilities.

Many coals may be stored for long periods without serious loss of "quality". Stored coals tend to lose heating value but the loss is slight. Bureau of Mines tests (Bulletin 136) show that such losses usually do not exceed about 1% for the first year or 2% in 2 years, except for low-rank coals, such as Wyoming subbituminous. These lose 2–3% the first year and up to 5.5% in 3 years.

Weathering tends to make most coals "slack", that is, causes a reduction in size, or "crumbling". This depends on the rank of the coal; "high-rank" coals, high in fixed carbon, slack least. Under good storage conditions, slacking extends only a short distance from the surface. Slacking represents a problem only where low-rank coals (lignite, subbituminous, and high-volatile high-inherent-moisture bituminous) must be stored.

Other changes that take place in stored coal include possible loss of "caking" and ignition qualities. For the majority of fuel-burning equipment these effects are negligible and need not be considered in relation to today's emergency storage problems.

SPONTANEOUS HEATING

Spontaneous heating is the one effect of storage that *must always* be given attention. Coal exposed to atmosphere combines with oxygen, liberating heat. This is as truly "burning" as what happens in a furnace, but occurs at an extremely slow rate. According to Bureau of Mines Technical Paper 409, all coals except anthracite undergo spontaneous heating; the tendency is greatest among coals of lowest rank (lignite, subbituminous, low fixed-carbon bituminous).

Oxidation occurs at room temperature as soon as freshly broken coal is exposed to air. As temperature increases, oxidation occurs at a faster rate; the reaction speed doubles for each 10-F temperature rise (approximately). Presence of finely divided iron pyrite increases the tendency to heat spontaneously, although coals containing virtually no pyrite also fire spontaneously. Amount of coal surface exposed to air definitely affects heating; small particles mean more exposed surface and therefore, other things being equal, more tendency to heat. Presence of moisture and sulphur tend to accelerate heating.

Oxidation becomes dangerous if heat developed is not removed as fast as it is generated. Then coal temperature rises, causing even more rapid heating. The reaction continues at an ever faster rate until the coal definitely "burns".

From the foregoing it would seem that ideal coal for storage would be sized, consisting of "egg" or "lump" pieces with the fines removed. Such coal would present a relatively small surface to air, minimizing the tendency to heat. If handled carefully to avoid breaking or compacting, the pile would be "open" allowing enough air to circulate to carry away any small amount of heat as fast as it was produced. But such coal is expensive and relatively difficult to obtain and must usually be crushed before use.

PRACTICAL STORAGE PROBLEM

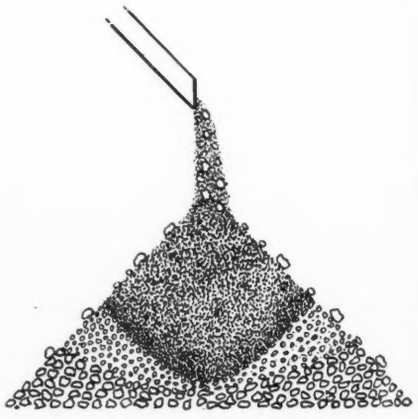
The practical problem, therefore, boils down to this: How can coal in the usual range of sizes be stored without spontaneous combustion? The solution lies not in ventilation but in keeping the amount of air reaching the coal surfaces to a minimum. This tackles the trouble at its source.

The first step in avoiding excess air movement through a coal pile is simple but often overlooked—eliminate segregation! When coal is dropped on a conical pile from a chute or spout, coarse pieces roll or slide to the outside and bottom while fines tend to stay in the line of fall. In such a pile, amount of air flow varies widely from place to place, because some parts are packed tight and others loose. There is always a chance that exactly the right amount of oxygen will reach some one spot and not enough heat will be carried away. One bad spot will heat the whole pile and trouble will inevitably follow.

Layer piling avoids difficulties resulting from segregation by insuring mixing of fine and coarse particles and thus preventing wide variation in air flow through the pile. Layers, from one to several feet thick, may be deposited as a series of small piles from the portable conveyor, clamshell bucket or other unloading device. The coal can then be distributed by a slip scoop; motor- or horse-drawn scraper, bulldozer or similar equipment. Where scrapers or bulldozers are available, they can handle the entire job, without need for preliminary piling. On small piles, hand distribution may be practical. Where coal is delivered by truck, the layers can be built up by dumping coal over the entire area and repeating the operation until the pile reaches the desired height.

Compacting carries the layer idea one step further. Coal is piled in thinner layers and each layer is "compacted" by caterpillar-tread action, by rollers, or by driving a truck across the pile. Compacting apparently depends to only a limited extent on the weight applied; the most important factor is the mixing action, bringing the coarse particles in close contact with the fines. According to G C Daniels ("Coal-Handling Systems for Central Stations"—*ASME*

FOUR WAYS



1—AVOID SEGREGATION

In ordinary conical coal piles, some parts are packed tight and others loose, causing differences in air flow through the pile. This encourages spontaneous heating

Coal Storage Safe

Transactions) coal compacted by bulldozers will weigh between 62 and 65 lb per cu ft as against 50 lb for loose coal and 56 at the bottom of a 30-ft uncompacted pile. Increased density resulting from compacting means less air circulation and less spontaneous heating and also permits piling 10–15% more coal in the same space. Experience in recent years indicates that compacting offers perhaps the best practical answer to the problem of safely storing large quantities.

Sealing represents another practical means of reducing air movement through coal piles and thus avoiding spontaneous combustion. M K Drewry ("Prevention of Spontaneous Heating of Large Coal Piles"—*Combustion*) points out that a continuous layer of fine coal, approaching pulverized fineness, makes an airtight coating that forms an effective seal. A second covering of lump coal prevents wind and rain erosion of the fine-coal layer. Coatings of asphalt and ground limestone have also proved effective.

Air leaks in a sealed pile usually can be spotted by a vapor discharge, which is most noticeable in cold or humid weather or in the early morning. Leaks so detected may be patched with fine coal to maintain the necessary airtight covering. Special attention should be given to eliminating leaks into the pile through porous bottoms such as coarse cinders, at openings around columns, and brickwork, or at points where the pile meets the ground or containing walls.

Proponents of sealing believe it to be more positive in preventing heating than compacting and more effective where coal must be stored for several years. Because sealing can be applied later, a practical solution seems to lie in trying compacting first. If trouble should develop, sealing can be applied and the trouble cured.

STORAGE UNDER WATER

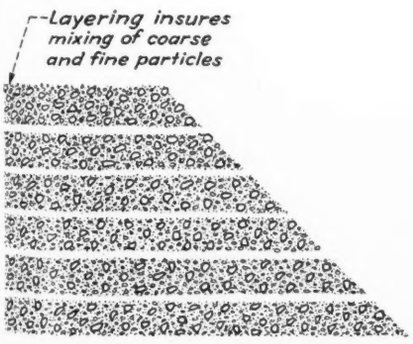
Storage under water prevents air from coming in contact with coal and the wetting does not materially harm the fuel properties, although excessive moisture may prove undesirable from the standpoint of handling and firing equipment. Unless local conditions are such as to make underwater storage easy, it does not represent a practical solution.

Successful coal storage requires careful preparation of the ground or indoor storage place. For outdoor storage, the ground must be prepared to make complete reclamation practical. This means that the surface should be level and free from foreign matter such as industrial waste, cinders, ash and vegetation. Good drainage is important; if moisture collects on the ground surface, provide cinder fill or buried drain tiles.

For either indoor or outdoor storage, be sure that the space is free from even small amounts of old coal. Take particular pains to avoid storing near external sources of heat, such as steam pipes. Arrange the pile so that older portions can be reclaimed first—dead coal space is a chronic source of trouble.

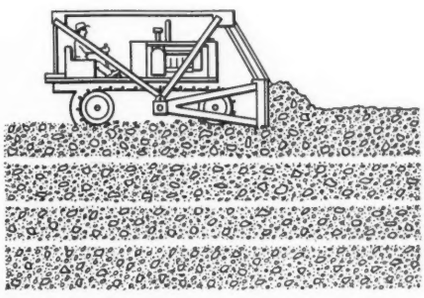
Coal in storage requires close watching, particularly during the first three months; the Bureau of Mines reports that three-quarters of coal fires studied occurred in this period. Check sealed piles regularly for air leaks. Best method for checking any pile is by temperature measurement. A simple setup involves driving an iron rod into the pile at intervals and testing temperature by feel. A more accurate procedure is to provide pipes on about 25-ft centers into which a thermometer may be lowered. Bottom of pipe should be plugged and top should be capped. A temperature of 120 F in a loose pile, or a slightly higher temperature in a compacted pile, indicates trouble. If temperature rises appreciably above these points, prepare to move the coal or apply a sealing coating. In general, avoid use of water on coal-pile fires; moving or sealing represents better practice.

TO MAKE EMERGENCY COAL STORAGE SAFE



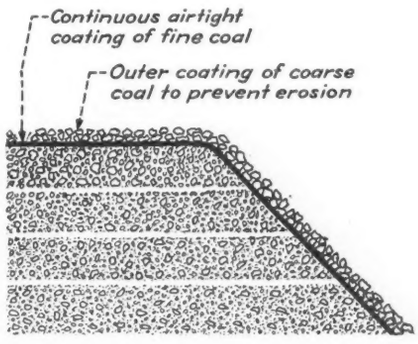
2—PILE COAL IN LAYERS

Layer piling avoids segregation difficulties by insuring mixing of fine and coarse particles and thus preventing wide variation in air flow through the pile



3—"COMPACT" THE PILE

Using a bulldozer, scraper or roller to compact the layers makes the pile denser, increasing storage capacity. Denser pile means less danger of spontaneous heating



4—SEAL OUTER SURFACES

Sealing outer surfaces of pile with layer of fine coal or other materials offers another practical means of reducing air flow and thus avoiding spontaneous heating

3 FUEL PROBLEMS

Effective Coal Storage Depends on "Know How"

THE POWER ENGINEER considering emergency coal storage must first face the problem of space. One solution lies in making better use of existing space by improving storage methods; such changes boosted one plant's safe storage capacity from 12,000 to 45,000 tons. Extending present facilities offers another answer. In some cases, operating coal handling equipment more hours a day will take care of greater storage requirements so that additional land may represent the only cost. In other cases, existing equipment must be extended. In any event, extending facilities offers definite advantages in convenience and ease of handling.

MANY NEED STORAGE SPACE

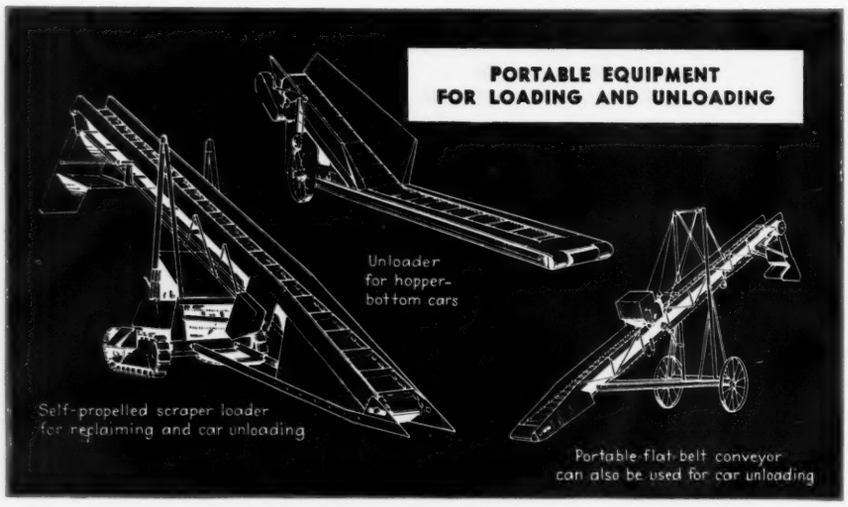
However, many plants must obtain completely new space. Obviously this should be as near the boiler house as possible. One plant reports converting the main parking lot to storage; another uses a section of abandoned right-of-way. Although no such cases have come to our attention, there is no reason why a plant with spare space could not cooperate with another that needed it, nor why a coal dealer with yard capacity could not store coal for nearby plants.

Handling coal in and out of emergency storage presents special problems. Because the job is temporary, first cost must be kept low. With all equipment difficult to obtain, installations must be held to a practical minimum and in many cases available machinery must be converted to coal-handling use. The fact that many storage spaces will be at some distance from the plant puts emphasis on portable equipment of all kinds. Because the emergency pile will be relatively "dead" storage in many cases, speed, ease of handling, and low operating cost may be sacrificed for low first cost and ability to obtain or improvise equipment readily.

The suggestions that follow grow out of the experience of plants, large and small, that have solved the emergency-handling problem. The methods described are not, of course, all the possible answers, nor do they necessarily represent what might be considered normal "best" practice.

Unloading methods depend on the way shipments are received. For most emergency storage piles this will be by truck or rail. If by truck, the load may be dumped to form a pile which is distributed by other means, or may be spread on the storage pile directly. In the latter case, the truck moves back and forth across the space, dumping a layer at a time.

Portable conveyors and unloaders may be used to handle rail shipments. If the car can be run up on a trestle or a pit dug beneath the tracks, a portable conveyor may be used directly. A portable unloader may be run under the car, either over or under the track; it discharges into the receiving end of a portable conveyor in most cases. Locomotive or stationary cranes, with clamshell buckets, offer another means of unloading cars. If the siding runs close to the storage space, the next step is distribution and piling; if not, the unloading equipment discharges into trucks for the haul to storage.

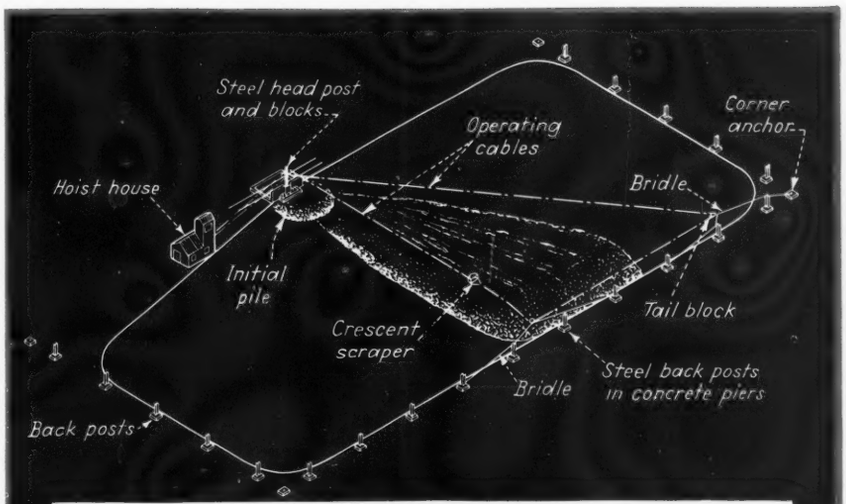

PORTABLE EQUIPMENT
FOR LOADING AND UNLOADING
Unloader for hopper-bottom cars
Self-propelled scraper loader for reclaiming and car unloading
Portable flat-belt conveyor can also be used for car unloading

BUILDING THE STORAGE PILE

Any one of several methods may be used for building the pile, which should be carefully layered to avoid segregation. Drag-scrapers offer a simple and low-cost solution in many cases. For small and medium-size piles, the arrangement shown on pg 91 finds common use. It consists of steel backposts spaced at intervals around the outer edge of the storage area. A bridle cable stretched between the backposts carries the tailblock. The scraper moves between the headpost and the tailblock, carrying coal from the dumping point to the storage pile or from storage to the head end for reclaiming. The tailblock may be shifted along the bridle cable and the cable may be moved from post to post to change the line of travel of the scraper bucket. In larger installations, a traveling tower, running on rails at the storage-space edge, carries the tailblock. Generally the tower contains a motor and propelling machinery, governed by remote control from the head end.

Various types of portable equipment can be used to move coal from the unloading-point pile and distribute it in layers over the storage area. For small spaces a horse-drawn slip-scoop or scraper offers a simple and relatively effective arrangement. Where possible, it is desirable to pack each layer by rolling.

Tractor equipment now finds wide use in storing and reclaiming coal. On small and medium piles, a bulldozer can be used effectively; on larger piles the tractor pulls a wheeled scraper which unloads and loads under control of the tractor operator. Such equipment does a good job of compacting and offers the further advantage of handling economi-



Drag-scraper installation for small or medium piles. Steel back-posts are spaced at intervals around outer edge and bucket is shifted to different sectors by moving tailblock on bridle cable

cally any short hauling required (up to several hundred feet).

An industrial plant in the east reports adapting to coal-storage work a bulldozer originally purchased for snow removal. When this plant converted from gas to coal, a small portable conveyor was purchased. Dropping the end of this conveyor into a track hopper makes it self-loading; it discharges to a conical pile 30 ft from the track. The bulldozer moves coal from this point to storage, about 50 ft from the track. The storage pile is approximately 100x110x15 ft. Running the bulldozer over the pile spreads the coal evenly, without segregration, and packs it hard. Although some of the coal has been in place over a year, there has been no sign of heating.

The experience of a middle-western plant illustrates several of the methods suggested and shows what can be done to increase storage without adding ground area. Irregular in shape, the 145,000-sq-ft storage space was originally served by a locomotive crane. Space taken by tracks and the shape of piles formed by dumping from the crane bucket limited safe capacity to 10–12,000 tons, about one month's supply.

Decision to use a tractor and scraper for storing and reclaiming permitted removing all tracks except two running adjacent to the plant and connecting with the railroad. One track extends to a trestle from which barge shipments are unloaded by clamshell bucket. At a point some distance away an outdoor hopper receives coal from either railroad cars or the tractor-drawn scraper. A conveyor connects the outdoor hopper to a skip-hoist-loading hopper; the skip-hoist carries coal into the plant. Another conveyor from this hopper discharges into the yard, permitting putting rail coal into storage.

Present operation of this arrangement (see photo) centers around the tractor-drawn scraper. This picks up coal unloaded from barges, taking it either to the storage yard or to the outdoor hopper. The scraper discharges storage coal in thin layers in successive trips over the pile, building it up to any desired height and compacting it. When coal is reclaimed, the scraper again loads itself and unloads to the outdoor hopper.

The new system permits safe storage of 45,000 tons, more than three times as much as before. During the past year, heating occurred only once, on a slope where there had been no compacting. Running the tractor over the spot packed the coal and prevented further heating. Elimination of surface oxidation permitted carrying increased loads burning storage coal and increased operating efficiency on stored mid-western coal about 4%.

Tractor-drawn scraper (circled) moves coal from unloading point to storage pile or to outdoor hopper supplying plant. Change to compacted piling boosted storage from 12,000 to 45,000 tons and eliminated losses

PART

4

SHARING MACHINES MATERIALS MANPOWER

All-out war on the power front cannot stop with interchange of electricity and steam or cooperation on fuel problems. United action must extend also to equipment and materials—even to manpower

Swapping Supplies and Equipment Maintains Output

EVERY RESPONSIBLE MAN in industry is keenly aware of present material and equipment shortages. All kinds of machinery and metals now require preference ratings. For some equipment the rating is so high that the equipment is practically unobtainable by most plants.

WPB LIMITS EXPANSION

That is why, for example, the War Production Board has limited utility expansion to 5,000,000 kw for the duration, although the original conservative plan called for 8,000,000 kw. WPB ordered the cut to save steel and conserve the manufacturing capacity of boiler, turbine and generator makers. It is almost impossible for any industrial plant whose product is not a war necessity to buy a new boiler or turbine.

Under such conditions common sense dictates the harnessing of the nation's supply of new or partly used equipment. Certain standby utility plants will not operate at capacity. Some industrials making peacetime goods actually operate at reduced power and steam loads because they cannot fully convert to war production. Their *available* power and steam capacity, then, is increased by the war. If the excess can't be delivered to a point of use, the equipment itself may be uprooted and replanted in a new location.

SEARCH OUT SPARE PARTS

Thousands of plants all over the country have stocks of used and unused parts—valves, fittings, pipe, boiler tubes, shafts, pulleys, gages, etc, some of which may not be needed on the spot in the near future. As the war proceeds such items will be pooled for the common good.

The trends and possibilities can best be made clear by examples of what has been done to date. To

WHAT'S BEING DONE

War Production Board lists unused power equipment and directs such exchanges as the shipping of old boilers from a northern central station to a southern war-production plant.

Utilities reshuffle parts of major equipment (boilers, stokers, turbines, generators, etc).

Neighborly engineers everywhere help each other out with spare valves, fittings, etc.

Competing boiler manufacturers work cooperatively on the same job, even on the same piece of equipment.

Electrical manufacturers help customers rebuild old machines so they won't have to buy new ones.

Turbine manufacturer hires customer to help build the turbine customer ordered.

avoid giving away strategic information names will be deleted.

A large utility in the East has several plants in neighboring communities. Suburban plant *A* had six old boilers that were originally fired by stokers. However, the stokers had been removed some years before and the boilers were idle. The war increased the community power requirements and brought a demand for means to fire the idle boilers.

In one of the older city plants of the same company were six unused stoker-fired boilers. The stokers were reinstalled in the suburban plant. In addition many parts were salvaged from the city-plant boilers for reuse in the suburban plant.

SWAPPING BIG UNITS

An industrial plant was about to be shut down because it could not obtain immediately certain spare parts for a traveling-grate stoker. A paper mill in a neighboring city sold this plant its spare stoker parts to tide over this emergency.

A utility in the Northeast was told that its boilers were needed for a new war chemical plant in the south. The boilers were shipped and are now operating in the new location. There have been other similar cases.

An important ordnance plant in the midwest required a large motor generator. The local utility furnished an 1800-kw unit, 13.200 volts on the primary, delivering 250 volts dc.

Return tubular boilers with 6-in. tubes, used as waste-heat boilers on a blast-furnace operation, had their operating pressure so reduced by inspectors as to lower the plant's steaming capacity to a dangerous degree. A quick search unearthed some 72-in. boilers with 4-in. tubes. These now operate at a 15-psi pressure increase.

UTILITIES SHARE METERS

Some power companies in adjacent territories have already pooled their stocks of transformers. A pool of meters for exchange among utility companies was inaugurated at the October, 1941, meeting of the Meter and Service Committee, Edison Electric Institute, and the Committee on Metering and Service Methods, AEIC. Lists of surplus stocks of meters were interchanged between the various members and some conservation of materials resulted.

Recently all utility companies in the country were requested to submit lists of surplus domestic watthour meters to the War Production Board. WPB subsequently issued a catalog of these surplus meters for use on war housing projects. This WPB activity has to some extent replaced direct action among the utilities in this matter, but the committees stand ready to pitch in as needed.

A check made by POWER in the middle of July showed that the Surplus Used Equipment Section of the War Production Board had located, and indexed in suitable form for allocation, a substantial volume of power equipment. This included 20,000 motors, 3000 boilers, 1000 engine-generators, 400 turbine-generators, 300 motor-generators, 250 diesel-generators, 1000 generators, 300 steam turbines, 150 diesel engines, 200 steam engines, 100 gas engines, 400 rotary converters and 5000 miscellaneous pieces of equipment.

Used equipment that had been substituted for new equipment up to that date through this service was approximately as follows: three complete generating plants amounting to 32,000 kw, 450 boilers rated from 1000 sq ft up to 250,000 lb of steam per hr, 21 engine- and turbine-driven generators from 100 to 12,500 kw, 600 electric motors ranging from fractional to 2850 hp, five motor-generator sets ranging from 100 to 500 kw, three 50-kw diesel generators, and about 150 miscellaneous items.

NAPE POOLS EQUIPMENT

Indicative of the spirit of cooperation growing in engineering circles everywhere is the resolution adopted at the recent New York State Convention of the National Association of Power Engineers.

In brief, it was resolved that the members in New York State shall pool "with a common depository to be nominated by each subordinate association, or list with a common custodian so to be nominated, all available plant machinery, equipment and materials not in use and which may or may not be obsolete, which can be placed in subsidiary service in times of emergency."

Equipment manufacturers have gone a long way from accustomed procedure to meet emergency conditions. One large electrical-equipment manufacturer reports that "working jointly with utility engineers, we have developed plans for the rebuilding of many old generators so that additional electric power can be added to the national supply without making heavy demands on critical materials. These same engineers by cooperative effort have produced auxiliary cooling equipment that enables transformers to carry additional loads. This eliminates, in many cases, the necessity for new transformers."

Here is a unique example of manufacturer cooperation: A large steel company needed two 25,000-kw turbine generators. Because the plant of the turbine manufacturer is fully occupied, the customer, acting as a subcontractor for his own supplier, is machining spindles and casings in his own plant.

WHAT ELSE SHOULD BE DONE

Every utility and every industrial power engineer should make a complete inventory of unused equipment.

This inventory should include unused valves, fittings and traps, as well as big units.

It should include both new and used equipment—anything that is not needed and won't be, whether it's on the stock shelves or installed in the plant.

It should include badly worn inoperative equipment if a little shop work and reshuffling of parts would put it in commission.

Any equipment that cannot be made usable should be junked now, so the metal can be reused to help win the war.

4 MANPOWER, MACHINES

Pooling Manpower

WHEN THE JAPS STRUCK at Pearl Harbor about 6,000,000 Americans were in war-production employment, including war plants and transportation, power production and governmental employment directly connected with the war. On Jan 1 the figure was 7,000,000; on April 1, 9,000,000; on July 1, 12,500,000. In the last half of 1942 we are adding another 5,000,000, according to Chairman Paul V McNutt of the War Manpower Commission. On top of all this millions of men are going into the armed services.

REVOLUTION IN EMPLOYMENT

All in all, the employment picture in this country is being revolutionized, almost overnight, and with it comes a parallel revolution in methods of training and selecting men and in accepted ideas of what constitutes adequate preparation for a job. Normal machinist apprentice training was formerly four years. Now men take a 10-week school course and then go into production. True, they are not real machinists, but they do have some skill in special operations.

Finally, bosses and employers have been forced to revise their ideas of what constitutes a suitable man for a job. Necessity has made many men acceptable who would not ordinarily be considered. And many old-timers—once considered fit only for retirement—are judged the most desirable of all because they have valuable experience and are not eligible for military service.

SWAPPING AND TRAINING

The power field, like every other, faces an employment problem that will become acute within the next few months. A year from now much more will be known about how to handle a national manpower emergency. But already some good experience is available; here are samples:

Experienced power-plant men have been loaned to the government to repair propulsion machinery of damaged ships.

In several instances operating men have been loaned by one utility to another, or by a utility to an industrial, or vice versa, to tide over an emergency situation.

The biggest advances made have been in the selection and training of power employees. The steam superintendent of a large Canadian paper mill writes stressing the importance of chief engineers adapting themselves to the new situation.

The essential thing is for the chief to train his men so that they can be transferred from one job to another, readily, safely and without impairing plant efficiency. Wise bosses prepare in advance for the loss of the key men to the military service. "There is no lack of unskilled over-military-age workers available to start in on the ground floor. In a year's time, if properly trained and coached, they will be able to move along and individually do their bit."

ADVANCE PREPARATION

In the days when the workers' market was overcrowded, says this engineer, employers became too choosy, insisted on unnecessarily strict medical examination, and often required college degrees for vacancies needing no such qualification. "All that is changing, and there is no reason at all why hundreds of jobs cannot be handled by men rejected for military service, or men over the age limit, that are now handled by healthy, strong individuals sheltering under the banner of reserved occupations."

An engineer in Milwaukee writes that for five years he has been training former boiler operators to serve as emergency operating engineers.

An outstanding example of training inexperienced men to handle real responsibilities is obtained from the Masonite Corp, Laurel, Miss. This company put into operation a new 13,500-kw 410-psi power plant with the operating crew listed in the box on this page. Most of the men were either semi-experienced or entirely without power-plant experience. Yet with the aid of equipment manufacturers' engineers in the starting phases, the station has been practically free of troubles, according to Plant Engineer E G Grady.

From his observation, Grady contends that "a person with no previous experience with modern equipment, but who has a normal intelligence and is receptive to instructions, can be made a satisfactory operator faster than one who has to unlearn the older manner of operating."

THESE MEN STARTED, RAN 13,500-kw MASONITE PLANT

(See text)

GENERAL
(not for any specific shift)

ONE CHIEF OPERATOR
Turbine experience

ONE MAINTENANCE MAN
From mill, pump experience

ONE INSTRUMENT, TEST MAN
From process dept. No mechanical or electrical experience

ONE TURBINE AND SWITCHBOARD OPERATOR PER SHIFT

1st shift—Former process boiler tender. Never saw a turbine
2nd shift—Former meter man and emergency turbine operator. No previous experience with modern machines
3rd shift—Former substation operator; also emergency operator of above station
4th shift—Former engineer with a sawmill

ONE BOILER-ROOM ATTENDANT PER SHIFT

1st shift—Former clerk in maintenance office
2nd shift—Former truck driver
3rd shift—Former millwright
4th shift—Former warehouseman with ice-plant experience

ONE MAN ON CONDENSER, PUMPS, COOLING TOWER

1st shift—Former millwright's helper, used on construction
2nd shift—Former warehouseman
3rd shift—Former helper in process department
4th shift—Former grader; some electrical experience

ONE MAN ON GENERAL HELP AND CLEANUP

Each shift—A college freshman in cooperative course

WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

Read This First!

EVERY NOW AND THEN the editors come in for some good-natured ribbing from manufacturers and others who read an isolated item in this department without clearly understanding its purpose. They say, in effect, "why should a presumably first-class magazine like POWER devote space to descriptions of such antiquated homemade devices and methods?"

To all such we give notice, again, that this department is a first-aid kit for the wounds of war, not a school of peacetime perfection. This department tells you what to do when you can't do what any reasonable man would under normal conditions. Many of the items presented here are what a rubber boat is to an aviator landing on the ocean—what a floating oar or a slab of wood is to a shipwrecked seaman.

Some of the homemade bearings we have described have caused mental pain in higher engineering circles. Admittedly they are crude, but let us ask our critics this question: "What would you do if (1) you were in charge of maintenance, (2) a vital machine was shut down for lack of a bearing, (3) the plant was set to lose needed war production every hour the machine was down, (4) you could not get a new bearing for love or money? Would you look for a makeshift, or would you sit down and wait for something to happen?"

Years ago one of POWER's present associate editors was troubleshooting for an elevator-maintenance company. An elevator motor burned out its babbitt bearing late one afternoon after the supply houses were closed. This man cut a long strip of sheet copper from an old-style toilet float box and wound it around the shaft as a makeshift substitute for babbitt. Maybe this bearing *was* extremely bad practice. But it maintained service, and that's what counts!

—PHIL SWAIN

Bearing Relined By Centrifugal Casting

A BEARING FAILED and caused a shutdown when our stock of white metal was low and we lacked a suitable mandrel for a core. Use of the centrifugal casting process conserved metal, made a core unnecessary and saved a long shutdown.

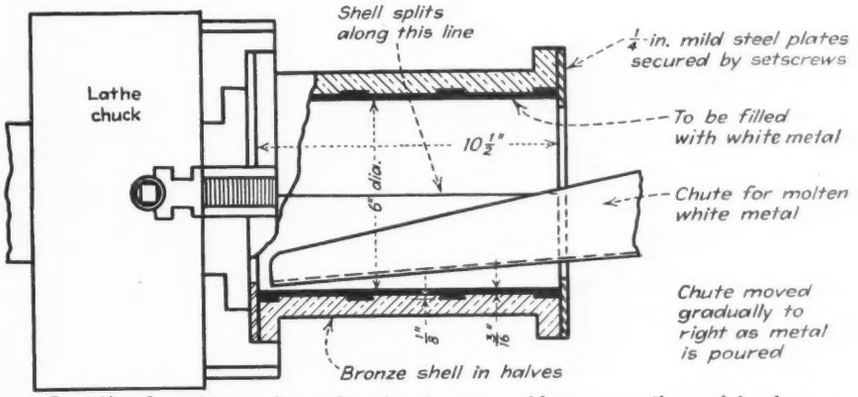
The bronze shell was undamaged, so we burned out the old metal, then cleaned and tinned the bronze. Plates attached as shown in the sketch held the two bronze halves together and also provided flanges to hold the molten metal during the casting.

The assembly was chucked true, heated to insure free flow of metal, then spun at the highest lathe speed while the molten white metal was fed through a mild-steel chute, as indicated. Started at the left, the chute was gradually moved to the right during the pouring. The lathe was kept spinning until the white metal had set hard.

As might be expected, the casting was homogeneous and left little metal to be removed in the final boring operation.

After boring, we cut the white metal lining along the lines of the shell joints.

Johannesburg, South Africa H DOUGHTY


Shell splits along this line
¼-in. mild steel plates secured by setscrews
Lathe chuck
To be filled with white metal
10½"
6" dia.
Chute for molten white metal
Chute moved gradually to right as metal is poured
Bronze shell in halves

Centrifugal casting used to reline bearing; assembly spun until metal hardens

Repairing Switch Contacts

IT IS GETTING DIFFICULT to buy new contacts for electrical switches and starters, so this hint may be helpful.

Years ago I was asked to fix an old starter that had been made to order for the job. The manufacturer had been out of business for a long time and no repair parts were available.

It was a reversible switch for a 3-phase motor with six pairs of contacts. Removing the contacts, I found that one set was not as bad as the rest; at least it was good enough to reveal the shape it had when new, so I used it for a pattern in repairing the worn contacts.

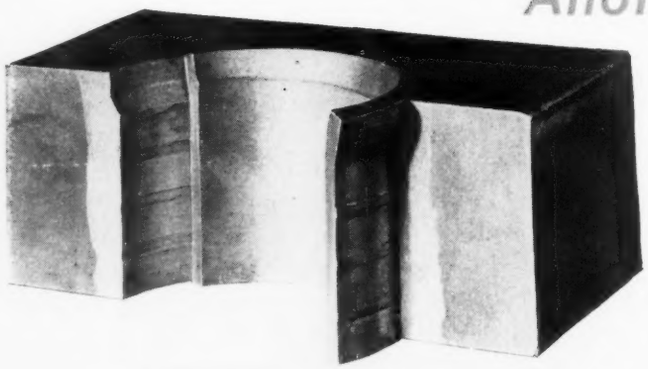
With bare copper wire as a "filler rod," I used an acetylene torch to build up the contacts to their regular size. Flat carbon blocks on the sides and bottom held the metal in shape.

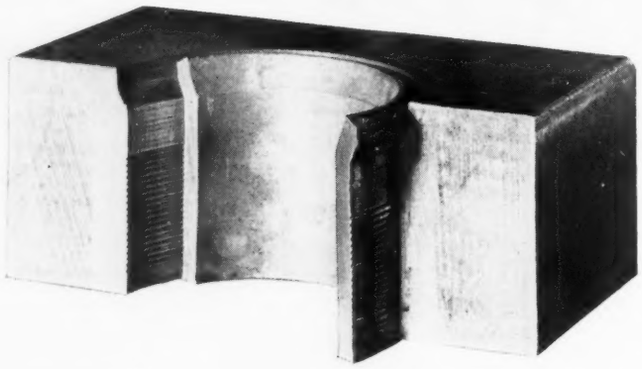
After depositing the copper and polishing the sides I used the same torch to coat the contacts with silver. You can buy old sterling silver at a jewelry store. Melt the old piece in a ladle and stir it with a green stick of wood for a few minutes. Then pour the resulting purified silver in long strings on a dry board to cast weld rods. Melt only a thin coat onto the contacts. Silver may also be applied to the contacts by dipping them in hot metal or by electroplating according to standard methods.

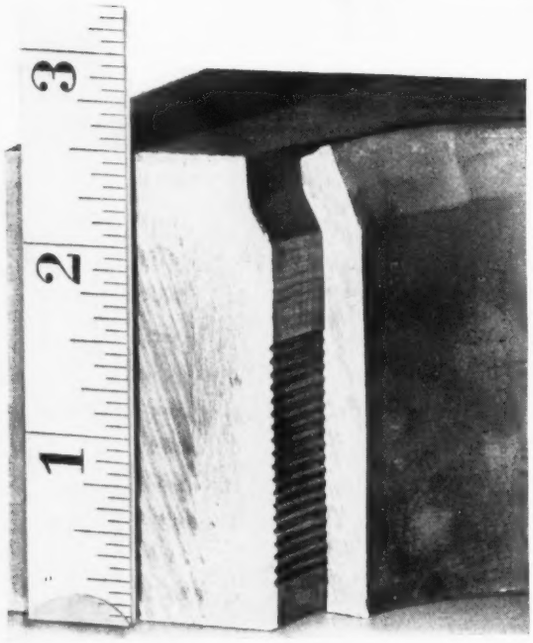
Warren, Pa. HARVEY E OSGOOD

A New Type of boiler tube hole

Another feature which adds to the superiority of Riley Steam Generating Units







It is well recognized that for units operating at high pressures, tube holes should be grooved to assure tight joints between drums and tubes. Formerly the type of grooving used consisted of a few comparatively wide grooves as illustrated in the upper illustration.

Recent research has proven, however, that far superior rolled joints are obtained if the new Riley type of grooving consisting of a large number of small grooves is used. This type of grooving is illustrated in the two lower photographs.

The use of small grooves, 15 grooves per inch, gives a rolled joint much stronger than that obtainable with the older method. Since the tube metal will flow with less rolling, completely filling each groove, a tight joint is assured, eliminating the possibility of damage to tube or tube hole from over rolling. Riley Steam Generating Units are giving satisfaction over many years of service because of this careful attention to each detail of design and construction in addition to correct basic design characteristics.

The use of small grooving was first developed by Scovill Manufacturing Company for use with condensers. The Riley Stoker Corporation was the first boiler company to develop this type of grooving for use with steam generating units and is the sole licensee in the boiler industry under Scovill Manufacturing Company patents.

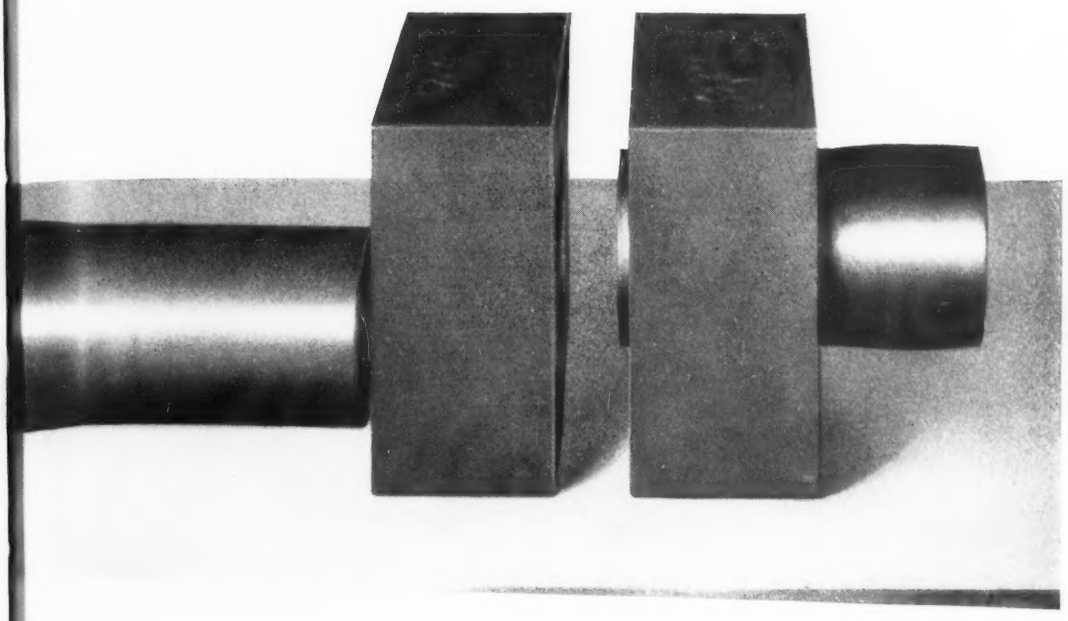
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

grooving which is far superior



A Comparison of the Efficiency of the old and new type of grooving

To determine the comparative holding power of the older and new Riley type of tube hole grooving, tubes were rolled in test blocks of each type of grooving and the joints tested under a hydraulic press. You will note that it was possible to extrude the tube, left, from the block machined with the old style grooving. However, such a tight joint was obtained with the Riley type of grooving, that the tube, right, actually buckled before the joint was even loosened.

In the field, the superiority of the Riley tube hole grooving is just as apparent. In spite of the lighter rolling of tubes with the Riley grooving, initial hydrostatic test invariably indicates no leaks and exceedingly few weeps. Users of boilers and steam generating equipment will find this feature one of major importance from a maintenance standpoint.

These Leaders of Industry have recently Installed Riley Boiler Equipment

Carnegie-Illinois Steel Corp.
Winchester Repeating Arms Co.
Allis-Chalmers Manufacturing Co.
General Electric Co.
Parke Davis Co.

Curtiss-Wright Corp.
General Motors Corp.
Dow Chemical Co.
Consolidated Aircraft Co.
Bell Aircraft Co.

Scovill Manufacturing Co.
Kennecott Copper Corp.
Western Cartridge Co.
Swift & Company
U. S. Gypsum Co.

Revere Copper & Brass Co.
Masonite Corp.
American Steel & Wire Co.
Standard Oil Co. of California
Standard Oil Co. of Indiana

Standard Oil Co. of Louisiana
Standard Oil Co. of New Jersey
Bullard Machine Co.
Humble Oil & Refining Co.
Socony Vacuum Oil Co.

Carolina Power & Light Co.
Houston Lighting & Power Co.
Norton Company
Celanese Corp. of America
Campbell Soup Co.

International Harvester Co.
Container Corporation
Kellogg Company
Republic Creosoting Co.
Shell Oil Company

Carbide & Carbon Chemical Co.
Modine Manufacturing Co.
A. O. Smith Corp.
Ruberoid Company
Nicholson File Co.

American Brass Co.
Publicker Comm. Alcohol Co.
Henry Disston & Sons
Gaylord Container Corp.
Eagle Picher Lead Co.

Republic Steel Corp.
Southern Indiana Power & Light Co.
Commonwealth & Southern Corp.
Union Electric Co. of Illinois
Union Electric Co. of Missouri

Iowa Illinois Gas & Electric Co.
Penn. Edison Co.
Florida Power & Light Co.
Central Illinois Light Co.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power cos's

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

The Manpower Problem

AMONG THE QUESTIONS puzzling engineers, Phil Swain lists two: "How can I replace the man who was drafted?" and "How can I break in a green hand quickly?"

We get a good hint on the first question by referring to William Doran's July instalment of "The Old Chief". To quote from it: "When the crisis came, we had every reason to be glad of his wandering habits because he knew every man's job to perfection. He was worth his weight in gold to us."

Many an oiler of today has been a good fireman in some other place or job, and many of the others have had some experience in other trades. If any of your men haven't had such a variety of experience, shift them around so that they too will be able to swap jobs when necessary.

A few of the older high-school boys might be helpful. Some plant men will scream at this suggestion, but here's my idea in full: The boys can be taken in during vacation and shown how to oil motors and small, relatively safe, machinery—how to wipe up, clean up, run for supplies, help the fitters and maintenance men. This will free experienced men for more important work. Then some of those older men, in turn, can take a lot off the engineer's hands.

If the boys do not go back to school (and I hope they will) they will be worth their pay. If they do go back, they have a good background for their school manual training, and a little more money for war stamps, school books and clothes. And, believe it or not, next year a lot of them will be back in the plant, for there's a certain fascination about machinery that they can't resist. With more education and manual training, plus last year's experience, they will be worth more and will have a fine start in engineering, a start that will go a long way toward preparing them to take the place of a lot of us old-timers when we have to step out.

Aurora, Colo. EDWARD J DUFF

McGraw-Hill Protects Elevator Machines from Water Damage

WHILE GATHERING CLINIC ITEMS from all parts of the country the editors found one on their own "doorstep", or rather in the penthouse of the McGraw-Hill building at 330 West 42nd St, New York. There, just above the 33rd floor and under the roof, are five traction machines serving the high-rise elevators—also five motor-generator sets, five control boards and a switchboard.

To protect this equipment from water that might be released from the overhead roof sprinkler tank in case of fire or air attack, the McGraw-Hill elevator maintenance crew, headed by Frank Schleiff, built pipe frames over all this equipment to support heavy waterproof canvas covers. In all, there are eleven of these covers in the penthouse. Eighteen more on the 17th floor protect six control boards, six traction machines for low-rise elevators, six motor-generator sets and one switchboard.

All of the frames are made of ½-in. steel-conduit pipe. Where convenient, joints are tees and side-outlet ells.

The cover frame shown in Fig. 1 (for a motor-generator set) is typical of the construction. Note that the top is pitched along the short dimension to help shed water. This pitch is obtained by bends in the vertical pipes as shown. In this and other frames screw joints are used only when full strength is required (as at the corners). In Fig. 1, the center cross pipe is fastened to the frame by the hook joint shown in the detail and in Fig. 6.

Mr Schleiff and his crew have found this type of connection convenient for many purposes. It also saves much labor and the cost of many fittings.

Space between pipes is crossed with wire as indicated to keep the canvas from sagging. The covers were made up to size from heavy canvas, treated to make it waterproof and fireproof.

Fig. 4 and 5 show variations in frame design to take care of special conditions. Fig. 4 shows the same cover as Fig. 2. Here the ends of the horizontals are supported in holes in the wall and the centers by vertical pipes with tees above and floor plates below. In this frame all of the cross pipes have simple hook ends, as shown in Fig. 6.

The control board cover (Fig. 5) required still another variation. One

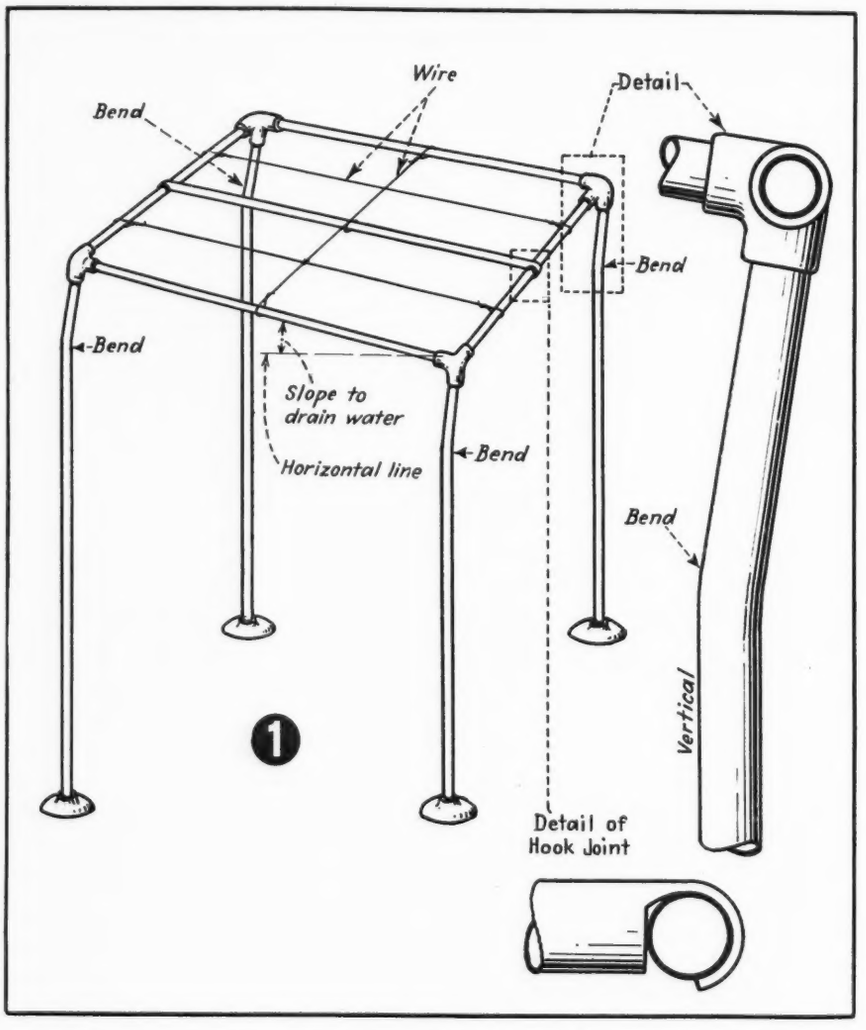
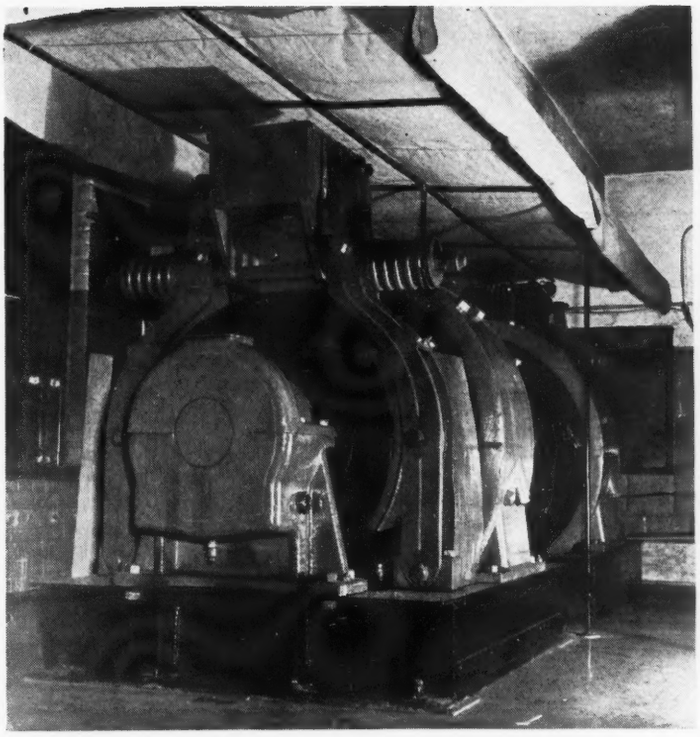


Fig. 1—Frame to cover motor-generator sets (Fig. 3). See Fig. 6 for hook-joint details



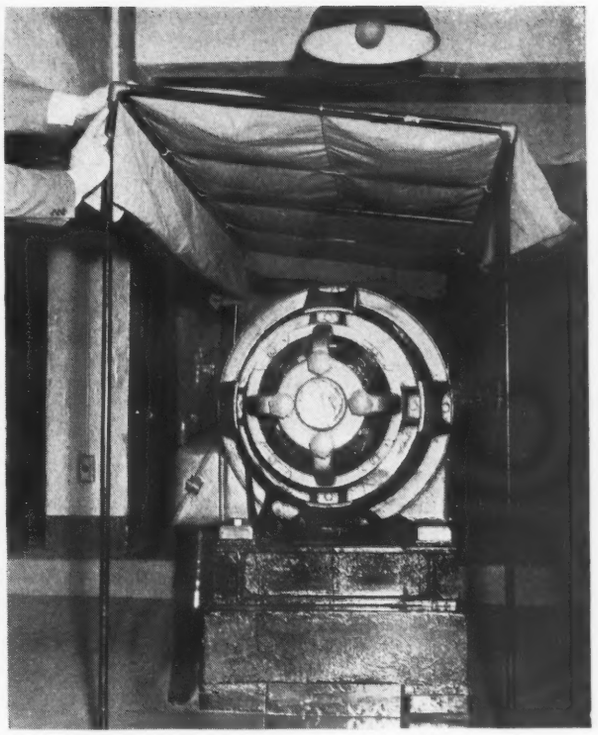


Fig. 2—(Left) Single cover protects pair of traction machines. Horizontal pipes end in wall holes at both ends. Three vertical pipes support centers. All cross pipes have hook joints. (For details see Fig. 4). Fig. 3—(Right) Motor-generator set and cover (same as Fig. 1). Bends near top of vertical supports slope cover down to right for quick drainage of leakage water

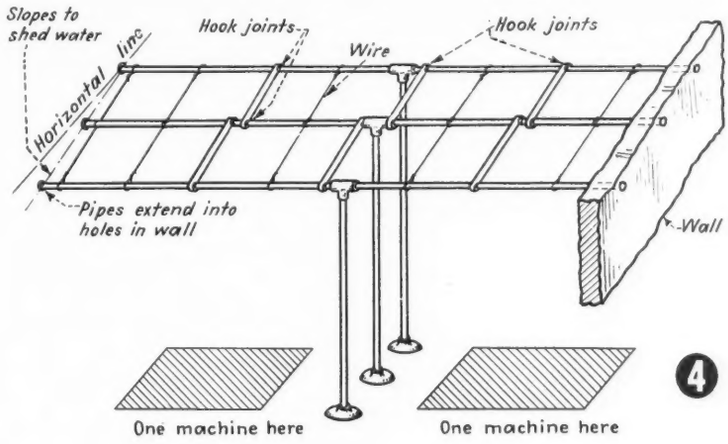
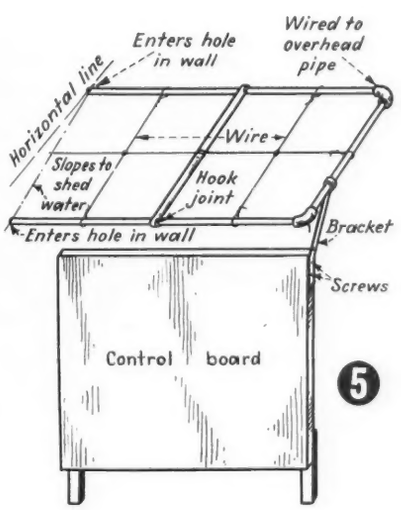
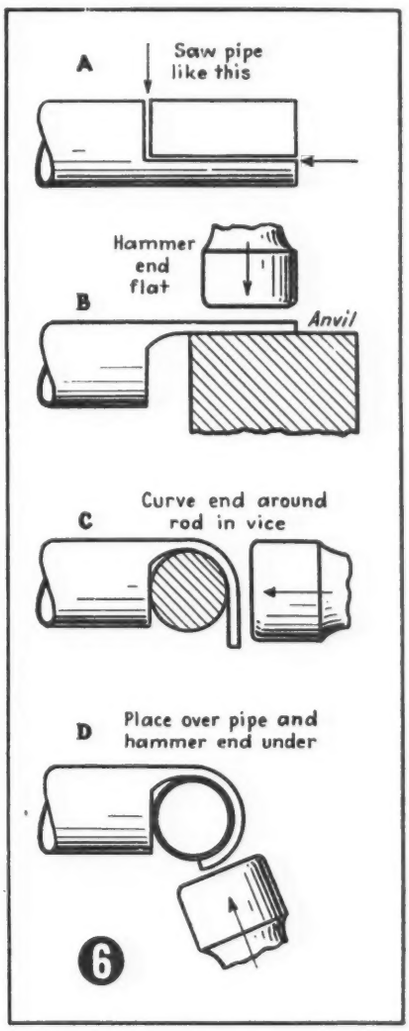


Fig. 4—Sketch of single cover for two traction machines (Fig. 2). Fig. 5—Control-board-cover frame is supported by wall holes at one end. Other is wired to overhead pipe and bracketed to end of board. Fig. 6—Hook joint saves fitting, threading and difficult assembly where full strength is not required



end is supported in wall holes and the other by bracketing one corner to the end of the control board and wiring the other to an overhead pipe.

Design and all work, except cutting and sewing canvas, were handled by the McGraw-Hill elevator-maintenance staff: Frank Schleiff, Charles Elter, Pete Gyarmathy and Daniel Daly.



"GUARDIANS OF

AN ARMY WE CAN ALL JOIN!

WHEN the call of the bugle is loud and the smell of powder is in the air, it's hard for a man to go about his daily toil without longing to get into uniform and lend a hand. But if you are one of the folks who have "jobs to do", remember that once our armies are locked in battle, their last great resource is the efficiency of the production machine at home.

And it's not just a matter confined to direct war work but efficiency straight down the line that counts. Whether your business is making shells or washing clothes, if you can keep your plant going efficiently and well-protected with "stitch-in-time" type of repairs you will be handling your sector of the front with merit.

Wars have a habit of being won by the people who can stick to it the longest. Now is a good time for you to do some reconnaissance on the plant maintenance front. The less ground lost, the easier it will be to support an all-out offensive.

Keep your old traps in GOOD REPAIR

A NEW BULLETIN

★ ★ ★ ★

HERE is a new bulletin designed to help plant maintenance men get the maximum life out of their steam traps. The data includes suggestions on installations, testing, inspection, repairs, and "trouble shooting." If you have not already received a copy of this guide, send us your name and we will be glad to mail one promptly without obligation.

EFFICIENCY"

Use GOOD TRAPS *on new jobs!*

ARMSTRONG
TRADE MARK
WHY IS IT YOU SO SELDOM SEE STRAINERS AHEAD OF ARMSTRONG TRAPS?
BECAUSE THEYRE SELF SCRUBBING!
SEE OUR CATALOG IN SWEET'S

NO more metal is required for a good trap than for one ill-suited to the service, and frequently less. Yet, time after time, installations go in that soon have to be replaced simply because the service is too severe. The result is double expenditure of money, metal, and manpower.

Armstrong Traps are built to stand up under the hardest possible service and therefore require very little maintenance on any kind of service. Armstrong furnishes very complete data to make *trap selection* quick, simple, and accurate. In addition, Armstrong traps are backed up by an outstanding group of factory representatives covering every principal industrial center. For complete protection, use Armstrong Steam Traps.

TO HELP YOU MAKE YOUR ARMSTRONG TRAPS *last even longer*

ARMSTRONG MACHINE WORKS

812 Maple Street, Three Rivers, Michigan

Builders of Steam Traps and Producers of Parts for War Equipment

Protect Steam, Water And Electric Sources

IN WAR TIME, the power plant becomes the heart of the nation. A power failure which holds up production for a few hours or a few days may cause the death of hundreds of our fighting men. The engineers are responsible for the continuous operation of their plants; what are they doing to insure it? It is up to every engineer to overlook nothing that will help keep his plant in operation, no matter what happens.

One of the most essential requirements is water. Either a reserve supply or at least two supply sources are necessary. An unused tank, converted and connected so that the water can be used in a boiler if necessary, will serve as a reserve. A nearby stream, lake or pond might be hooked up with a pump for an emergency supply. In some cases a well may be the answer.

Each engineer must decide for himself which solution will best fit into his plant. Whatever is done should be done with an eye to safety as well as effective and continuous operation.

If your plant has automatic control, part or all of which is electric, will an electric failure disrupt operation? Check the control to see if it could be operated entirely by hand in an emergency. What other electric power is used? Are essential pumps electrically driven? Check steam mains, water lines and all other piping. Every man in the plant from chief to ash man should know the pipe layout and where shutoff valves are located. Every man must be prepared to carry on, at least temporarily, if disaster should come.

The new method of army training, which gives the private as well as the general the required information necessary to attain the objectives, can well be copied in the power plant. Know your men and know you can trust each one. Then give them all possible instructions for carrying on in an emergency.

War production has overloaded most plants. This makes constant attention and care in operation and maintenance more essential than ever. A systemized maintenance schedule is a great help at any time, but no plant should be without one today. Repair parts are hard to get and should be conserved to the limit that safety and continuous operation will allow.

Guard against sabotage at all times. No one except the plant operating crew should be allowed in or near the power plant. Keep doors locked and windows heavily screened. Check incoming coal in some manner to make sure no foreign matter of a destructive nature is present. If a belt conveyor is used, station a man at the belt to watch the stream of coal. Other coal-handling methods require different ways of checking.

Homemade Crucible Furnace

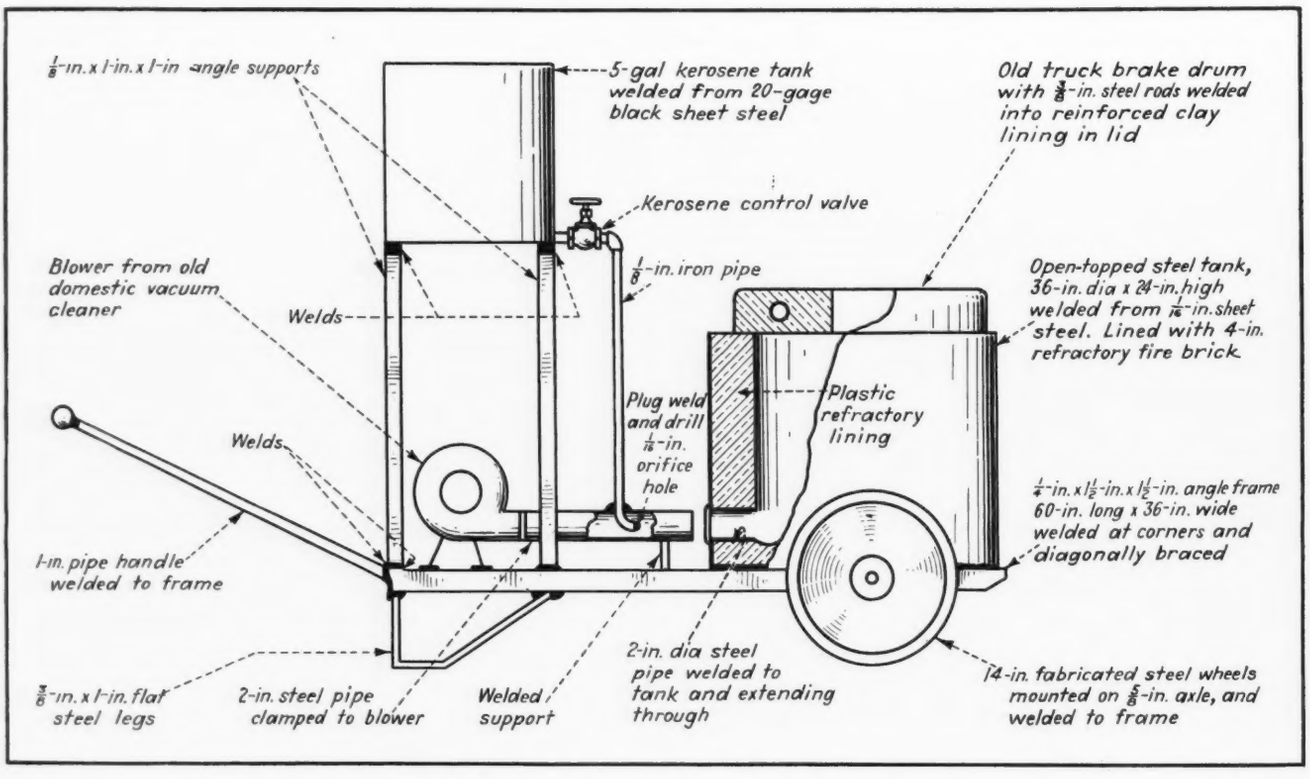
SEVERAL "CLINIC" READERS have expressed interest in building a small furnace to melt brass and other non-ferrous metals, as may be necessary in plant salvage operations such as casting bearings out of scrap brass, bronze and babbitt. The portable crucible furnace shown was designed by C P Philpot of Clemson College and first described in the *Hobart Arc Welding News*.

With arc welding this furnace was built largely of scrap for less than $20.00.

The notes on the drawing are sufficiently detailed to permit any mechanic to build his own along similar lines. In general, dimensions have been omitted because each builder will vary them to fit his particular requirements and available parts.

Operation of this furnace is simple. The kerosene is atomized in the stream of rapidly moving air. On entering the furnace it burns with a flame hot enough to melt any low-temperature metals and even brass or bronze. The outfit is portable, and may be used wherever 110-v current for the blower is available.

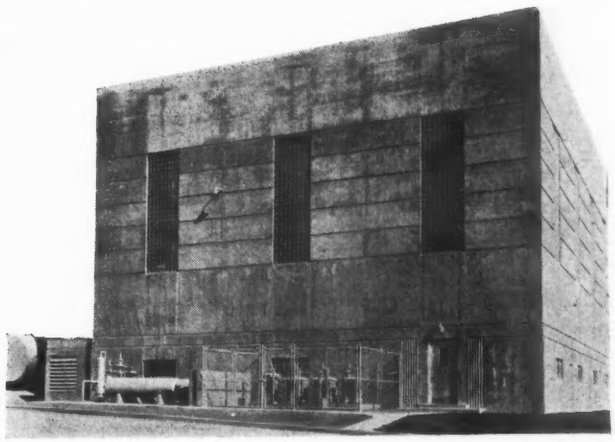
The extensive use of scrap (such as the brake drum for furnace lid) not only saves money but often, in these days, may be the only way to obtain the necessary materials.


1/8-in. x 1-in. x 1-in angle supports
5-gal kerosene tank welded from 20-gage black sheet steel
Old truck brake drum with 3/8-in. steel rods welded into reinforced clay lining in lid
Kerosene control valve
1/8-in. iron pipe
Blower from old domestic vacuum cleaner
Welds
Open-topped steel tank, 36-in. dia x 24-in. high welded from 1/16-in. sheet steel. Lined with 4-in. refractory fire brick
Plug weld and drill 1/16-in. orifice hole
Plastic refractory lining
Welds
1/4-in. x 1 1/2-in. x 1 1/2-in. angle frame 60-in. long x 36-in. wide welded at corners and diagonally braced
1-in. pipe handle welded to frame
3/8-in. x 1-in. flat steel legs
2-in. steel pipe clamped to blower
Welded support
2-in. dia steel pipe welded to tank and extending through
14-in. fabricated steel wheels mounted on 5/8-in. axle, and welded to frame

Constructed mainly of scrap for less than $20.00 in materials, this portable furnace melts low-temperature alloys, brass and bronze

Gas-Burning Diesels Give Fuel Flexibility

Universal Atlas Cement Co installs three 2000-hp dual-fuel engines, now operated on natural gas, in its modern power plant at Waco, Texas



► CAPABLE OF BURNING either heavy fuel oil or natural gas on the diesel cycle, three Nordberg engines power the outstanding 6000-hp plant of Universal Atlas Cement Co, Waco, Texas, placed in service September, 1941.

Now operating on natural gas, the engines, of 2-cycle crosshead design, are rated at 2000 hp each, at 225 rpm, with five power cylinders at 21½-in. bore and 29-in. stroke. Each directly drives a Westinghouse 1500-kw 2400-volt 3-phase 60-cycle generator; engine extension shafts drive the exciters through Allis-Chalmers multiple V-belts.

These engines are basically air-injection diesels with directly driven 3-stage compressors to provide the air blast for properly atomizing heavy fuel oil. When running on natural gas, the automatically regulated compressor raises gas pressure to approximately 1100 psi at discharge. Scavenging air is provided by a direct-connected reciprocating pump.

A timed fuel valve with variable lift, under governor control, regulates quantity of gas injected into the working cylinders. A small amount of fuel oil, called pilot oil, is pumped into the fuel nozzle, and when the fuel valve opens, pilot oil is blown into the cylinder by the compressed gas. The pilot oil starts and stabilizes combustion.

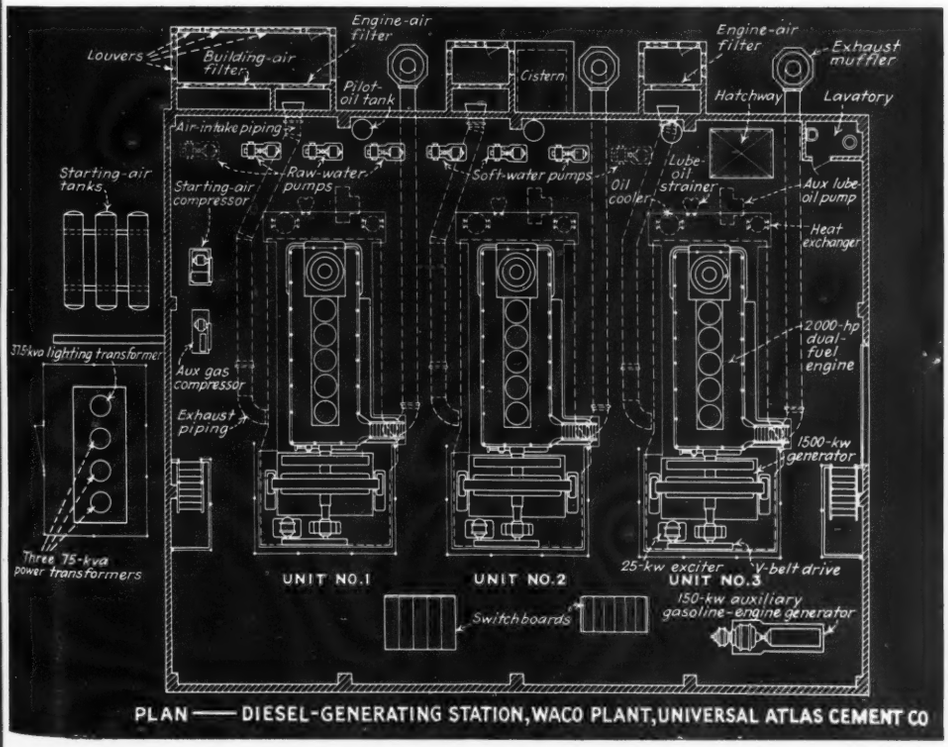
Thermal efficiency and exhaust temperature remain approximately the same, whether the engines operate on fuel oil or natural gas. Exhaust temperature at full load is about 550 F so that water-jacketed exhaust manifolds and down-pipes are not necessary. These manifolds are covered with heat-insulating material over which is fitted a welded sheet-metal covering. Elimination of manifold jacketing minimizes the quantity of heat rejected to the water-cooling system and avoids the troublesome scale formations which ordinarily occur in water-jacketed exhaust manifolds required on engines having higher exhaust temperatures.

Earlier Nordberg air-injection diesel engines were equipped with fuel-oil injection valves mechanically actuated by cams and push rods, which were replaced by hydraulic actuators when the engines were converted to operate on natural gas. The engines in this plant and all current designs intended for dual operation on either fuel oil or natural gas are equipped with standard hydraulically actuated fuel-injection valves with variable lift, under governor control. This improvement simplifies the engines, eliminates improper timing caused by wear of mechanical parts, and greatly reduces the period required to change from one fuel to the other.

Air is compressed in the working cylinders to the usual diesel compression pressure, approximately 480 psi, and natural gas and pilot oil are injected into this compressed air which is heated to about 1000 F by the compression process. This temperature is far above the ignition and burning temperatures of the fuel so that no ignition equipment such as magneto and spark plugs is required.

In a broad sense, the over-all efficiency of an internal-combustion engine is a function of the compression pressure attained; the higher the compression pressure within certain limits, the higher the overall efficiency. The amount of air compressed and the compression pressure of the Nordberg die-

Plan shows general arrangement: virtually all rotating auxiliaries are on the operating floor, with piping, oil coolers, strainers and heat exchangers in the basement



PLAN — DIESEL-GENERATING STATION, WACO PLANT, UNIVERSAL ATLAS CEMENT CO

sel gas engine stay always in the same range regardless of load; consequently the combustion temperature decreases with a decrease in load because the same amount of air is heated with a lesser amount of fuel.

Comparison with Otto Cycle

The otto cycle, on which conventional gas engines operate, requires that the ratio of air to gas inducted into the working cylinders be substantially constant at all loads. In other words, the proportion of air and gas must be the same at all loads, and the compression pressure of the combustible mixture must be below the pressure at which the resulting temperature will ignite it, thus limiting the compression pressure to about 125 psi in slow-speed otto-cycle engines. Because of the constant air-gas ratio requirement of the otto cycle, the temperature of combustion remains the same regardless of the load. The exhaust temperature drops with the load, but always runs higher than that of the diesel cycle at any given load. Exhaust temperatures of an otto-cycle gas engine run from about 800 F, at no load, to 1000 F, or higher, at full load.

Many mechanical improvements have been incorporated in these Nordberg engines to increase the wearing life of important parts, reduce maintenance cost, and simplify maintenance procedure. Cylinder lubrication has been improved by the introduction of lubricating oil at six points near the top of the cylinder liner. A separately driven 6-feed timed lubricator is used for each cylinder.

Main and crank bearings, of the shell type, have extremely thin anti-friction linings. These bearings are finished all over to close tolerances and require no scraping or shims. The anti-friction material employed and the process of spinning it in the shells eliminates the cracking of crank and main bearings, a fairly frequent occurrence in bearings with cast-steel boxes and thick babbitt linings. Crosshead pins have been enlarged in diameter and shortened in length in conformity with modern bearing-design practice.

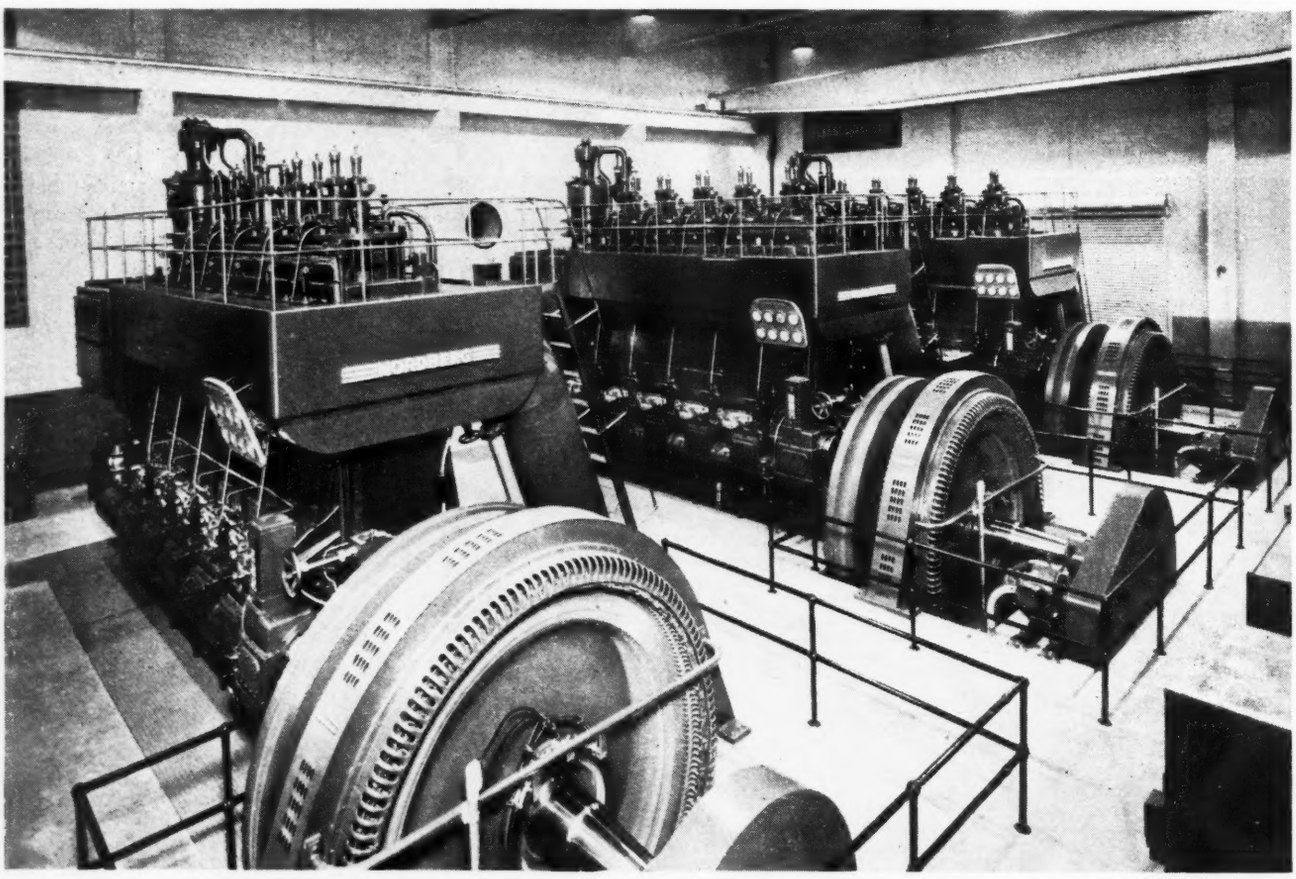
Adoption of streamlining wherever practicable brings pleasing results from the standpoint of engine appearance. Particular attention has been given to the exhaust and scavenging manifolds which have been enlarged as well as streamlined. Special care given to fitting of crankcase doors and frame joints prevents oil leaks.

The dual-fuel-burning engine operates successfully on a wide range of fuels, from heavy residual oils to lighter grades and gas, and the convertible feature enables the owners to take full advantage of any favorable competitive situation that may exist with respect to fuel oil and natural gas. A number of these engines have been installed in localities where natural gas is not now available, but where such service is expected at some future time, and in other localities where the cost of natural gas is not now competitive with fuel oil.

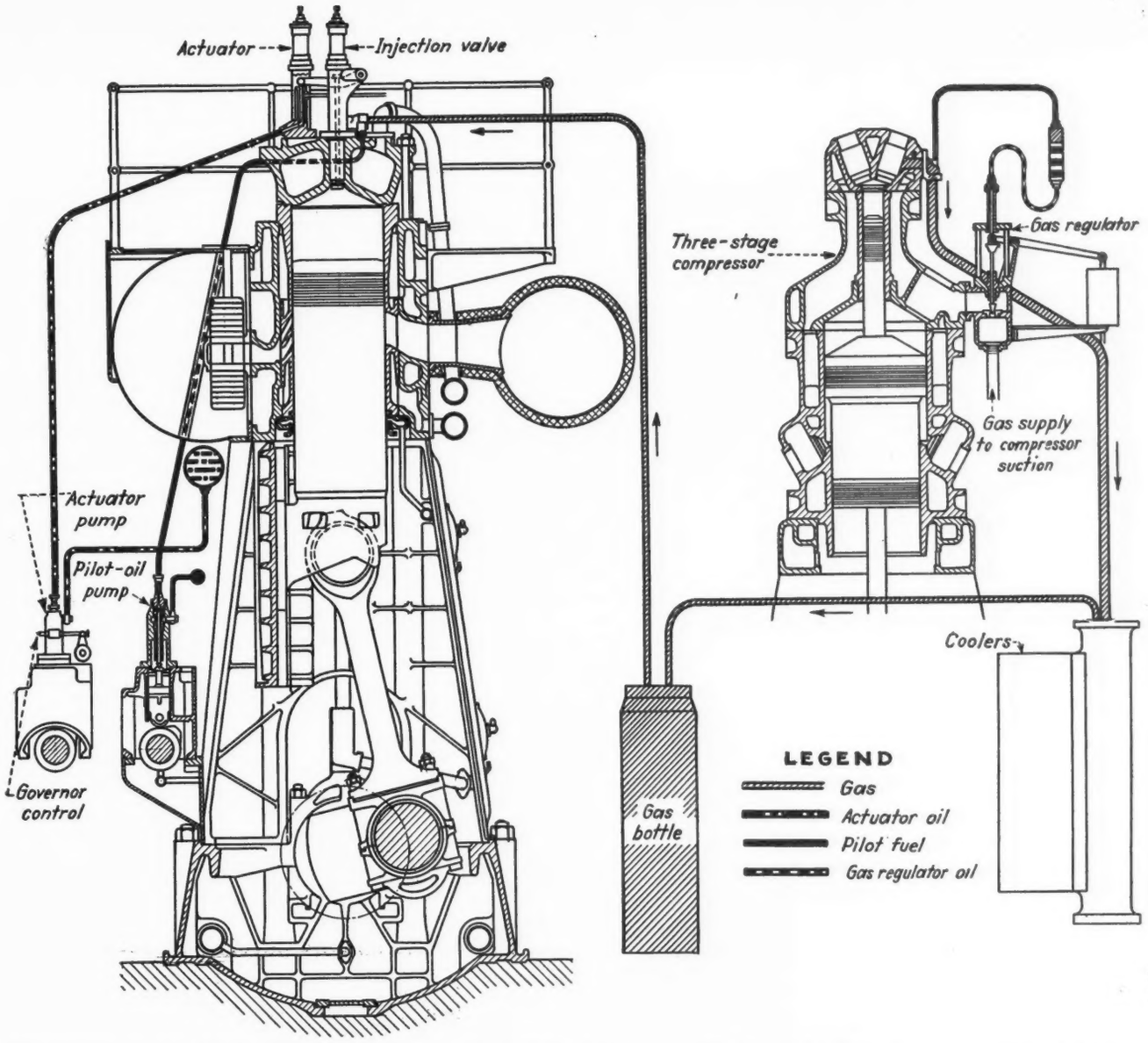
Air-Filtering System

Presence of dust around cement plants made it necessary to install a fairly elaborate system of air filtration for the engines and power-plant building at Waco. Three concrete air-filter houses abutting the plant building contain American viscous-impingement filter elements. Each house serves to filter the intake air for one engine. One of them also filters the air which is forced into the building. A Blaw-Knox gas scrubber removes foreign matter and insures clean, dry gas to the engines. Exhaust gas passes through Maxim silencers located outside the building.

The closed-circuit water-cooling system includes three Worthington 500-gpm single-stage centrifugal pumps located on the engine-room floor, one for



These three dual-fuel engines, now operating on natural gas, are 2-cycle units of crosshead design, rated at 2000 hp each



Cross-section at left shows engine construction; that at right shows automatically regulated fuel-gas compressor. Schematic piping indicates flow of gas and pilot oil and arrangement of hydraulic circuit for fuel-valve actuation and control

each engine. These draw soft water from a hotwell and pump it through Griscom-Russell heat exchangers, thence through the engine jackets from which it returns to the hotwell.

Three duplicate Worthington pumps, one for each engine, draw water from the basin of a Schubert-Christie forced-draft cooling tower and pump it through Griscom-Russell lubricating-oil coolers and heat exchangers, then over the cooling tower.

Three tanks, 50 cu ft each, store starting air at 350 psi pressure, supplied by a Gardner-Denver motor-driven compressor. A Gardner-Denver 1000-psi motor-driven gas compressor provides high-pressure gas for initial engine starting. It also may be used as a reserve for charging the starting-air tanks.

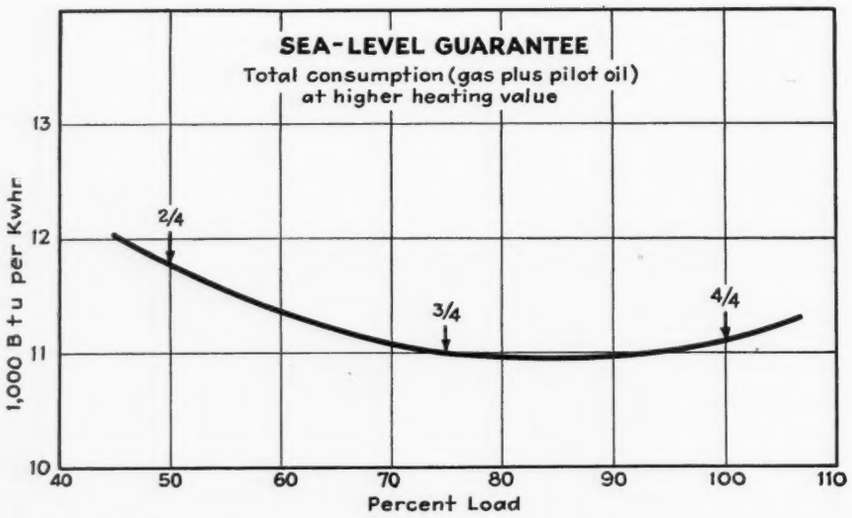
Each engine carries its own directly driven lubricating-oil pump, and, in addition, a Viking motor-driven pump which serves as reserve. This reserve pump starts automatically if the directly driven pump fails to maintain desired pressure. Lubricating oil from each engine passes through a Hilco reclaimer periodically.

The engines are equipped with Alnor pyrometers; Viking alarms give warning in case of low pressure or excessive temperature of engine cooling water or lubricating oil.

A Sterling gasoline engine directly drives a 150-kw 1200-rpm 440-volt 3-phase 60-cycle generator and its exciter for operation during year-end mill shutdown, to supply lighting and to start station auxiliaries.

All electrical equipment is of Westinghouse manufacture, including vertical-lift switchgear, with the exception of ITE draw-type breakers on the 440-volt circuit supplying station auxiliaries.

Unusual load conditions, typical of cement mills in general, presented some problems in the design of the diesel-generating units. A 1000-hp synchronous Compeb mill motor must be started under load when only two engines are running at 50% rated capacity. This is a severe condition for any prime mover with the rated capacity of these engines and required a detailed analysis of motor inrush current, speed of governor response, generator voltage, and speed reduction occurring during the starting period. It was found that starting operation of the motor imposes a momentary load of 3000 hp on the engines, which at one-half load are already carrying 2000 hp, making a total load of 5000 hp. This condition



Typical fuel-consumption-guarantee curve for engines of type installed at Waco

requires a design of the diesel-generator units having sufficient WR^2 to compensate for the momentary power deficiency without too great a reduction in voltage and with a speed reduction of not more than 5%. These conditions were met in a satisfactory manner by the use of extra-heavy flywheels, generators having 20% voltage regulation, and oversized exciters.

Fuel consumption and load data of this plant are not available for publication, but fuel-consumption guarantees on engines of this size and type are shown in the curve above.

The building is 84 ft 6 in. long by 66 ft 6 in. wide, measured inside the walls. The height from basement floor to main floor is 13 ft 6 in. and from main floor to bottom chord of roof trusses is 28 ft 6 in. A 10-ton hand-operated bridge crane was installed to handle maintenance work.

The building walls and main floor are built of monolithic reinforced concrete. The 10-in. thick walls were cased in plywood forms according to the specifications of the Portland Cement Association for architectural concrete. Steel trusses and purlins carry the precast concrete-tile roof. Asphaltic membrane roofing covers the tile. Windows are glass block and entrance doors are tubular steel.

A fan which draws 40,000 cfm of filtered air into the building provides ventilation. The fan discharges into a distribution duct; steel-grating floors around the engines permit forcing a large part of the ventilating air upward around the engines to remove radiated heat.

Plant water supply comes from an artesian well, and contains considerable alkali. A concrete cistern to hold rain water from the building roof provides soft water for engine jackets.

Specifications and design of the entire plant were prepared by the engineering department of Universal Atlas Cement Company.

Air-Cooled Condenser Solves Feedwater Problem

To avoid boiler makeup containing scale-forming minerals, an air-cooled radiator-type condenser provides condensate. This results in cutting boiler cleaning periods from two per week to one every 60 days. John C Albright, Los Angeles, Calif., presents operating details

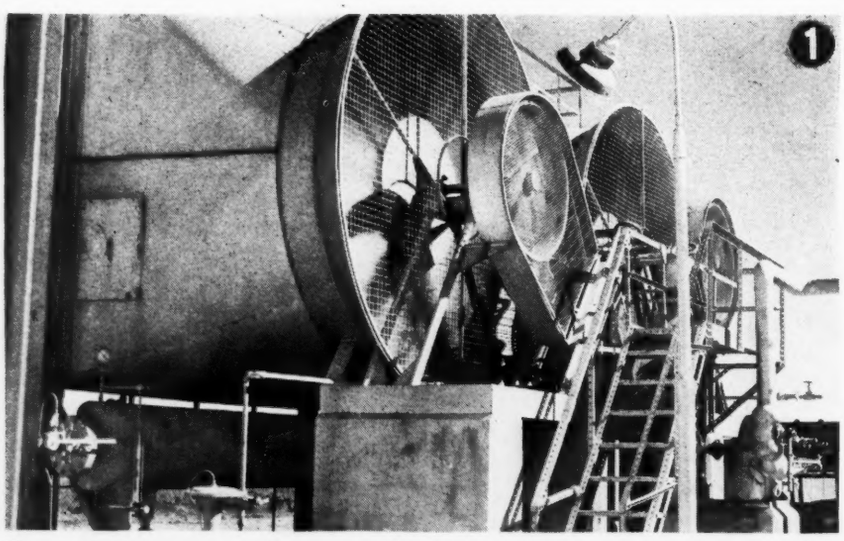


Fig. 1—Radiator-type condenser provides 14,000 lb of pure feedwater per hour where raw water conditions are very bad.

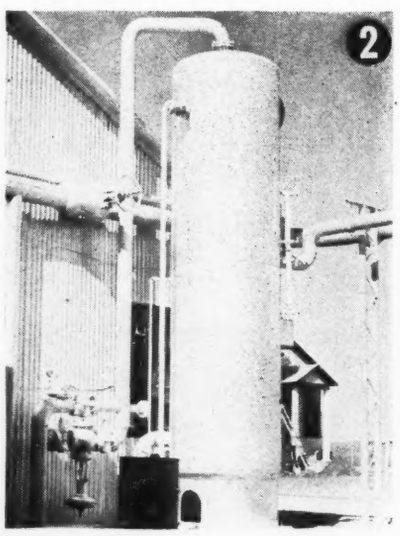


Fig. 2—Boiler feedwater hotwell into which both raw water and condensate with treating compound are pumped

▶ BOILER FEEDWATER is normally at a premium in certain sections of the oil-producing states containing few streams. The available water is frequently impounded in surface ponds or tanks and reservoirs filled from the local watersheds during rainfalls. This water contains large quantities of scale-forming minerals and salts leached from the soil and must be treated either before or after it goes into the boilers. Because of the inferior quality of the water and its scarcity during extended dry periods one large oil-producing company installed an air-cooled condenser to recover most of the exhaust steam from pumps and condensate from processes requiring steam.

When raw water alone was used in the boilers, scale formed quickly in them, frequently insulating the fusible plug in the crown sheets until overheating caused the plugs to melt. When this happened a boiler would be off the line until it was cleaned and repaired. Cleaning was necessary in some cases as often as twice weekly, even with boiler feedwater treatment. This condition existed until an air-cooled exhaust-steam condenser was installed and the boiler-feedwater chemists developed a successful treatment for a combination of raw water and condensate in the boilers. After this combination was placed in operation, the boilers could be in service as long as 60 days without cleaning. Then, when opened for inspection, they showed only a slight accumulation of scale; the loss of a fusible plug rarely occurs.

The radiator-type air-cooled condenser is designed to condense 14,000 lb of exhaust steam per hour when normal plant and atmospheric conditions prevail. Each condenser consists of ten 31x132-in. two-row sections of tubes with radiation fins. These are mounted in a steel supporting structure and piped to headers to operate in parallel. The units after assembly resemble a large automobile radiator. The open sides of the condenser were faced north because the prevailing winds in that section of the country are normally from the south. The rear of the units is fitted with twin shrouds, each covering five sections, and housing a 14-blade 10-ft fan with a rated capacity of 155,000 cu ft of air per minute. A 90-hp steam turbine on a low concrete foundation below the units connects directly to a gear speed reducer to drive the fans. Each fan is driven by standard V-belts from a common sheave on the speed-reducer output shaft.

Condensate from the condenser discharges from the sections through individual pipes, fitted with control valves, to a receiver where all the condensate is collected. This receiver, below the radiators, Fig. 1, is made of a section of 24-in. pipe and equipped with an internal float. This float governs the quantity of condensate in the receiver by controlling a steam-turbine-driven centrifugal pump which returns the condensate to the hotwell.

Condensate from process steam is trapped into a separate line which also leads to the hotwell, so that the amount of raw makeup water is held minimum. Needed makeup water is automatically delivered from the supply tank to the hotwell by a pump under the control of a float on the side of the hotwell. Water treatment is introduced into the raw water intermittently by an injector unit to maintain correct alkalinity of the blowdown. Blowdown is sampled frequently for laboratory tests to determine the quantity of treating compound to use to prevent scale formation in the boilers. The combination of condensed exhaust steam and feedwater treatment in the boilers solved the feedwater problem in this boiler plant.

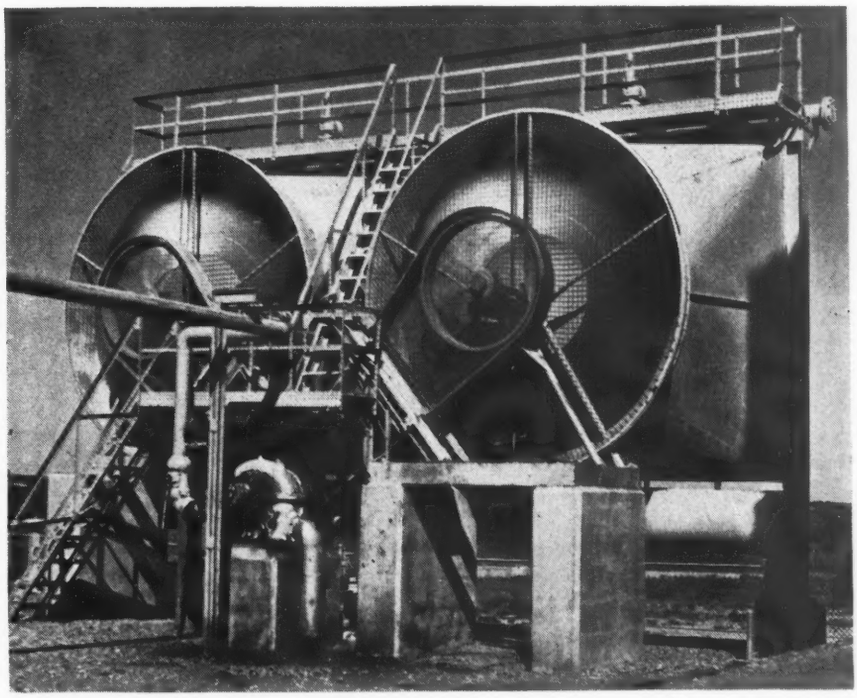


Fig. 3—Two 10-ft fans driven by V belts from one sheave on output shaft of a gear speed reducer connected to a 90-hp turbine, force air through condenser radiators

Part-Winding Method Solves Hard Starting Applications

Used on synchronous motors, this system saves space, simplifies control equipment. L W Ballard, General Electric Co, shows how it improves conditions on hard-starting loads

▶ MANY ENGINEERS CONSIDER part-winding starting the forgotten man in the family of reduced-voltage starting methods for synchronous motors. It should be investigated, however, whenever reduction in starting torque or current is needed on a synchronous-motor drive.

This method consists of starting a motor by using only a part of the complete stator winding. It therefore requires a motor with multiple-stator circuits. The starting sequence involves first energizing one part of the winding, then successively energizing the rest of the winding in one or more steps. The effect of this is to start the motor on partial torque and current corresponding to the part of the winding used, and to increase these values by connecting in more of the motor winding until the full winding is energized.

Part-Winding Hookup

Fig. 3 shows a typical part-winding starting arrangement. Here the motor winding has two multiple circuits and is started by first closing switch S and later closing S_1. Both switches S and S_1 remain closed during the running period. Use of a motor having three, four, or more multiple circuits results in 3-, 4-point starting, etc.

The most obvious advantage of part-winding starting compared with any reduced-voltage starting lies in the simplification of control equipment. No voltage-reducing device such as an auto-transformer, reactor, or resistor is required. Although the motor itself is more costly than a standard motor, it is essentially no more complicated. Hence the equipment as a whole ranks second only to full-voltage starting as far as simplicity is concerned. The starting switches are standard 3-pole units, and do not need to be mechanically interlocked, as is necessary in auto-transformer starting. Part-winding control, therefore, takes up less floor space and presents fewer devices to maintain.

A second advantage of part-winding starting is that the circuit to the motor is not opened during the starting period. Thus torque is developed continuously, giving smooth acceleration with minimum disturbances on the power system.

Flexibility characteristics which can be designed into synchronous motors make them fit unusual applications. The part-winding method extends this flexibility to permit closer matching of motor characteristics with torque requirements of the driven machinery, resulting in starting-current reduction. By special part-winding connections, either auto-transformer or reactor characteristics can be built into a motor, permitting full advantage of the torque-current characteristics obtainable by these methods in accordance with the needs of any particular installation. Fig. 4 illustrates typical characteristics obtainable in a part-winding motor where the windings are connected to give starting torque and current relations similar to those obtained with auto-transformer starting. Even when more than two starting steps are required, part-winding starting results in simpler and less expensive control than if an auto-transformer were used.

Fundamental characteristics of a

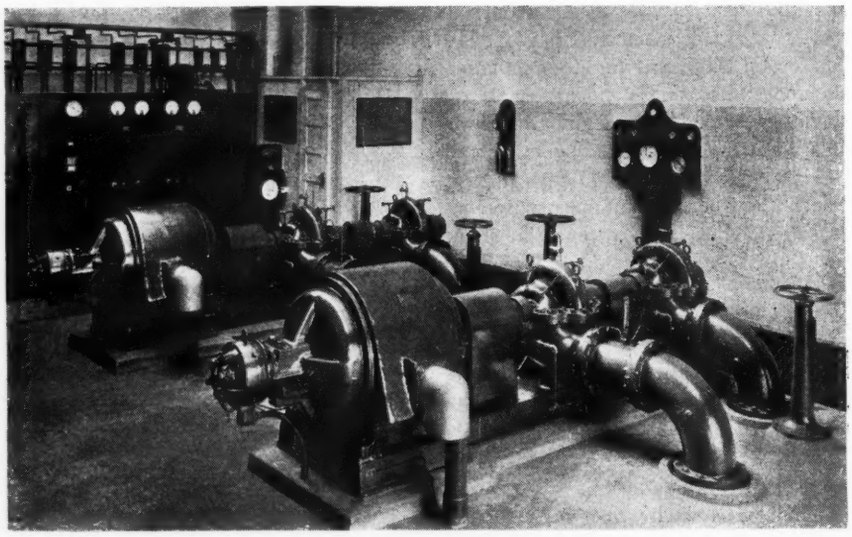
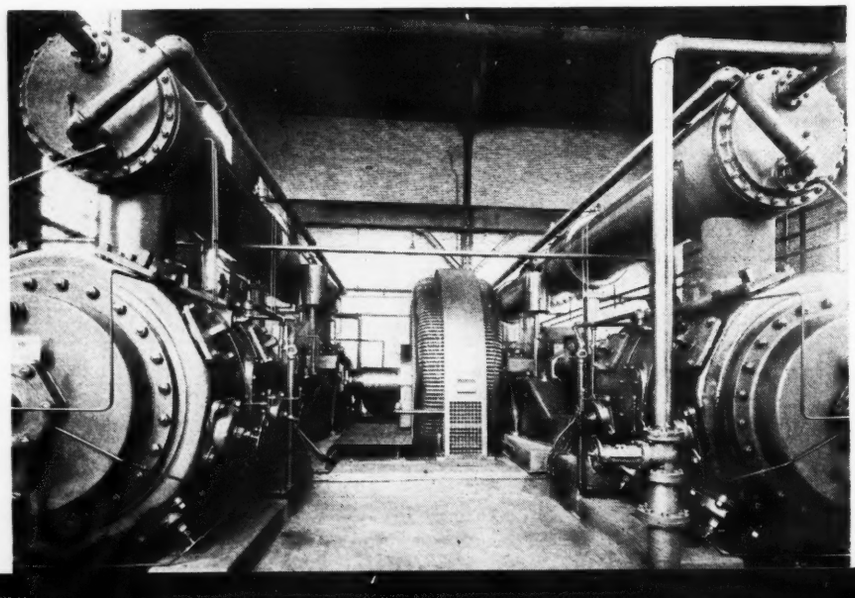


Fig. 1—Two 250-hp 1800-rpm synchronous motors with their windings arranged for part-winding starting, each driving two centrifugal pumps in a sugar refinery

Fig. 2—3000-hp 125-rpm 6600-volt synchronous motor, with its starter windings arranged for part-winding starting, drives a reciprocating gas compressor



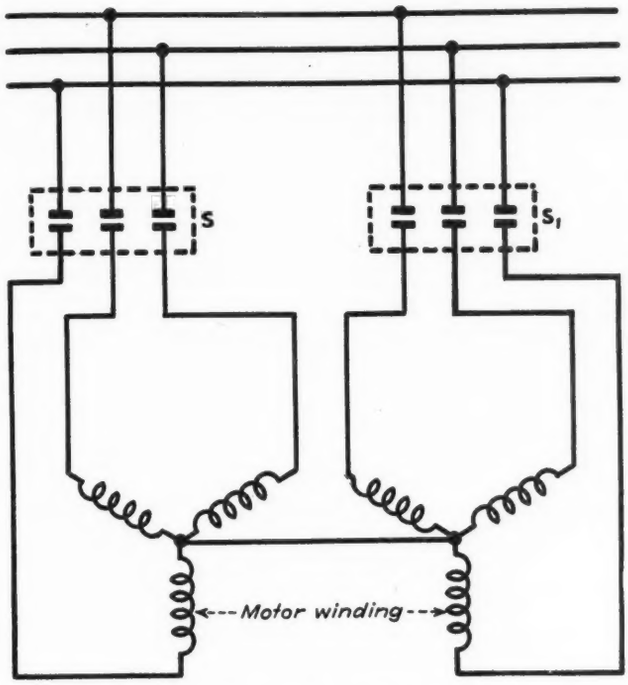


Fig. 3—Synchronous-motor stator winding grouped for 2-point part-winding starting to keep down starting current

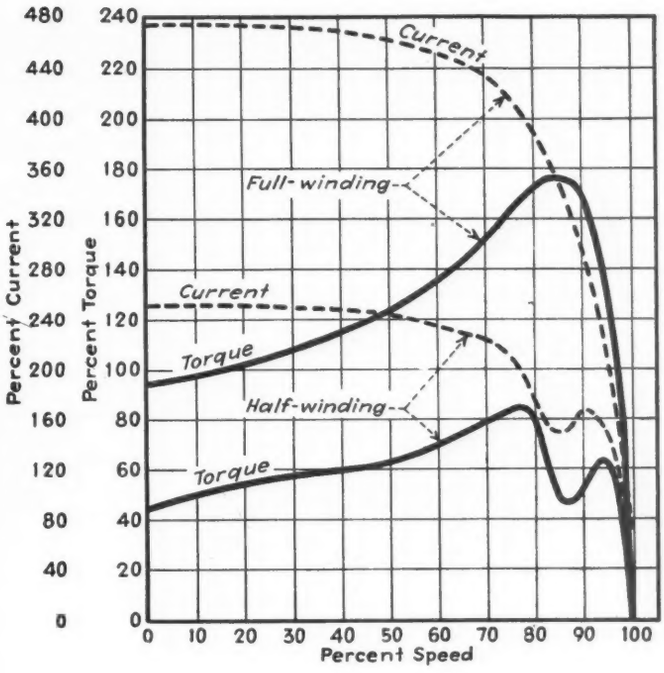


Fig. 4—Starting current and torque of 400-hp 720-rpm synchronous motor arranged for 2-point part-winding starting

synchronous motor are not changed by part-winding connections. In other words, the efficiency, pullout torque, excitation values, temperature rise, etc., remain the same as those for a comparable rated motor arranged for another starting method.

Experience has shown that certain combinations of motor horsepower, speed and voltage are not suitable for part-winding starting. This limitation is mainly centered in the low-horsepower, high-voltage class. As no general rule can be cited to define what combinations are not feasible, it is best to rely on the recommendations of the motor manufacturer.

Part-winding starting should be given consideration in all applications where a reduction in the full-voltage starting current is desirable. As in the case with reduced voltage, attention must be given to the starting-current limitation which exists and the starting torque required by the load. These must be compared with the torque and current obtainable from a part-winding motor, using the most suitable form of part-winding connection.

It should be remembered that the starting current and starting torque of the part-winding motor are fixed by the machine design. Consequently adjustments are difficult to make after the machine is built. It is, therefore, particularly important to predetermine accurately the torque requirements of the driven machine and anticipated voltage conditions at the motor terminals. This will insure obtaining the maximum starting-current reduction without running into danger that the motor will not start the load.

As an illustration of the matching of starting current to the power supply and the starting torque to the load characteristics refer to Fig. 5. In this case a 3-point part-winding motor was used. Where normal full-voltage starting would take 450% current from the line at start, part-winding reduced the initial current to 220%, then (in two steps) increased the current to 310% and to 335%. At the same time the starting torque was kept above that required to accelerate the mill. Synchronization occurred at about 97% speed, which was the top speed to which the amortisseur winding would accelerate the mill.

Part-winding starting is often used with motors having high starting torques and currents. Part-winding starting can be used to advantage to reduce these characteristics to more usable values. Centrifugal pumps, fans, lineshafts and tube mills are representative of this kind of drive.

Low-speed motors of normal design have relatively low starting currents and torque. However, with motors of high horsepower on power systems of low capacity, part-winding starting can be used to reduce starting currents, particularly where the starting current limitation is of the increment type. Another application of part-winding starting is on loads requiring a combination of high starting torque with uniform and smooth acceleration. Here motor torques can be built up in steps to correspond with that required by the load.

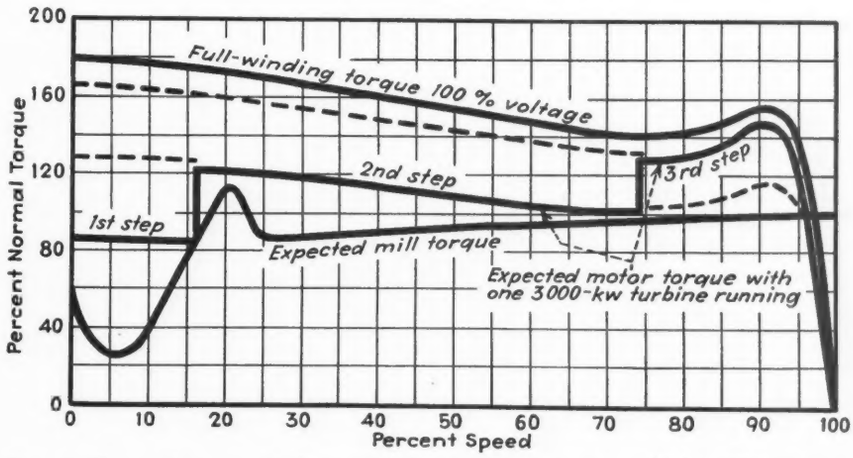
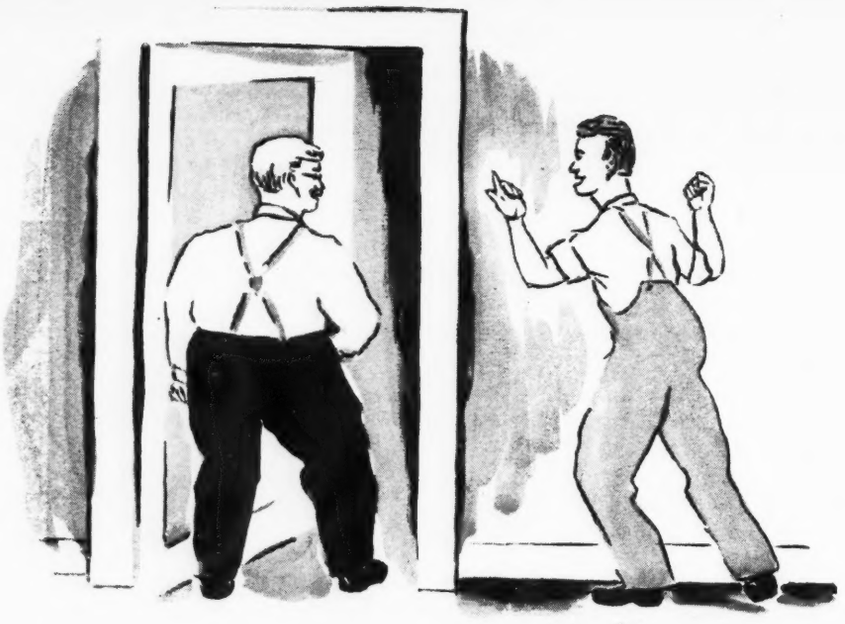


Fig. 5—Three-point part-winding starting characteristics of a 500-hp 180-rpm synchronous motor driving a ball mill in a cement plant with a limited power supply

The Old Chief

22—Popping Off



Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies beneath the maze of power costs and the wavy lines on paper disks

It's funny how front office
Ofttimes treats the engineer.
They build on plant extensions
Without a thought or fear

On how the old Tea Kettle
That labors with the load
Can be boosted up in rating
Before it will explode.

And if the engineer says "Whoa!
I'm sure this wreck won't do
The job that you're expecting,"
He's promptly told he's through.

So another Chief is hired,
And another after him.
'Bout then the first man's good advice
Begins to filter in.

So they make appropriations,
But they chisel on each dime.
They'll do it every time, man,
They'll do it every time.

—Ed Ryan, Empire-Hanna Co

▶ Four out of every five plants in the Old Chief's town were without question underboilered, and the fifth was underengined. Along about 1920 the new patent duplex fusible plugs were introduced and most plant engineers installed them. To the younger school who have never seen this gadget, I might explain that it consisted of a reinforced tube which extended through the boiler shell to the lowest safe water level. Above the shell there was a Y-casting with a fusible plug in each leg. In the event one of the plugs "blew", an unusual arrangement of duplex valves permitted that leg to be closed and the other plug to be brought in service without closing down.

It must be remembered that foaming and priming of boiler water and the blowing of fusible plugs very often went hand-in-hand, and we regarded them much in the same way as we did any other epidemic like measles, whooping cough or mumps. Our water, which we drew from wells, would work just dandy with soda ash for months on end; then without warning it would go haywire, and in spite of surface blowoffs and the closest attention, it was sometimes hard to tell where the water level might really be. In all this, the Old Chief was blameless.

He had been asking appropriations to allow him to install water-softening equipment for years but Front Office always could think up some reason why he could not have it. The architects did not approve of this or that location or the proposed capacity was too large or too small. On one occasion when he was again about to tackle the Board, I asked him what he thought would be the latest hold-up. He replied that the matter might be again held over due to spots on the sun!

Letting Off Steam

The one outstanding feature likely to command the admiration of an old-timer in the modern boiler of today is its flexibility. In the old days, the boiler-room foreman had to exercise good judgment in anticipating loads and had to prepare for off-load periods well ahead of time, if he wished to avoid popping the safety valves. When Big Red Hogan was in charge of the boilers, he would sooner miss his dinner than have one of his boilers "pop off". One evening the word had gone out that the factory was going to work through for two hours overtime. Later this order was cancelled for some reason. Because of an oversight on the part of one of the clerks, the news of the change in plans unfortunately did not reach Big Red. When we brought the big corliss down to idle, you could hear the safety valves popping all over the place. The Old Chief and I went down to help them get things back to normal.

Red was, as we used to say, "fit to be tied". He followed the Old Chief back to his office and pleaded for permission to go up to the production manager's room, "An' give him just wan tiny poke on the nose!" "Honest, Chief," he pleaded, "there's no use talking to that bunch of misfits; it would be a kindness to put wan or two of them out of their misery." However, the Old Chief passed up the pleasure of witnessing justifiable homicide and chased him back to his boilers.

Speaking of the amount of coal that one fireman would pass in a big day, I reminded the Old Chief of a very large tonnage that another fireman and myself had handled on one occasion.

The Old Chief placed his fingers to his lips and advised me to never mention a thing like that in the company of engineers. "No matter how much coal you have passed or seen passed," he cautioned, "there is bound to be someone in the crowd who will claim to have doubled your figures."

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Gilmer Tries Its Own Power-Saving Medicine

Editor Phil Swain tells how Philadelphia belting manufacturer saves power and money and speeds production by doing in its own plant what it recommends for others

Fig. 1—Plant Superintendent Richard Case (above) set the ball rolling at Gilmer two years ago when he appointed Bill Lose superintendent of maintenance, gave him the needed authority and executive backing and told him to get results

SHORTLY after the L H Gilmer Co made public the "Gilmer National Power-Recovery Plan," an organized drive to conserve power for war production throughout American industry, I learned that the company had been trying its own medicine. A trip to Philadelphia unearthed the story given here.

Biggest savings have been in electricity, water and compressed air. Manufacturers of rubber goods use these services in substantial quantities—electricity for power and light; water to cool process equipment; air and water for press operations.

These fit the Gilmer Plan, which promotes savings in all of the power services—steam, mechanical power, electricity, water, compressed air, refrigeration, heating, etc. But the actual plant accomplishments didn't stop there; the spirit and initiative that produced these economies made other changes highly beneficial to war production, though not properly classed as power-service savings. These include safety controls on the air compressors; a rig to black out the plant instantly in case of an air raid; improvements in laboratory equipment; longer-lived calendar clutches; improved gasket protection for hydraulic presses; reduced outage of sandblasting equipment.

Equally important is what might be described as the rejuvenation of Gilmer's entire maintenance organization. More than any other single circumstance, this explains the recent advances and makes it certain that many others will follow.

This forward movement in Gilmer maintenance extends back to 1940, when plant superintendent Richard Y Case decided that something must be done to substitute planned or preventive maintenance for the hit-and-miss variety. Case assigned this responsibility to William C Lose, who had been with the company for many years as plant electrician and had worked up the hard way.

The other maintenance men knew that Bill Lose was not one to be satisfied with hit-and-miss methods, so his reappearance on the scene as boss of all maintenance caused some initial misgivings in the ranks. It looked like the good old days, when maintenance consisted in fixing things that broke after they broke, were gone. Lose's idea that

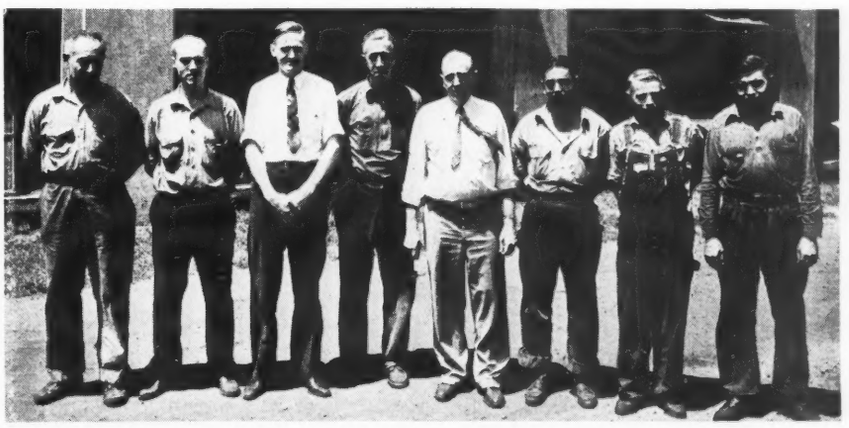


Fig. 2—Gilmer's maintenance bosses, left to right, William Hall (mechanical maintenance), Edward Coryell (electrical maintenance), Richard Craig (asst supt of maintenance), Howard Keller (sanitation, steam and water), William Lose (supt of maintenance), Harry Mitchell (experimental laboratory maintenance), Joseph Zieske (carcass machine and special machines), Frederick Keebler (sandblast maintenance)

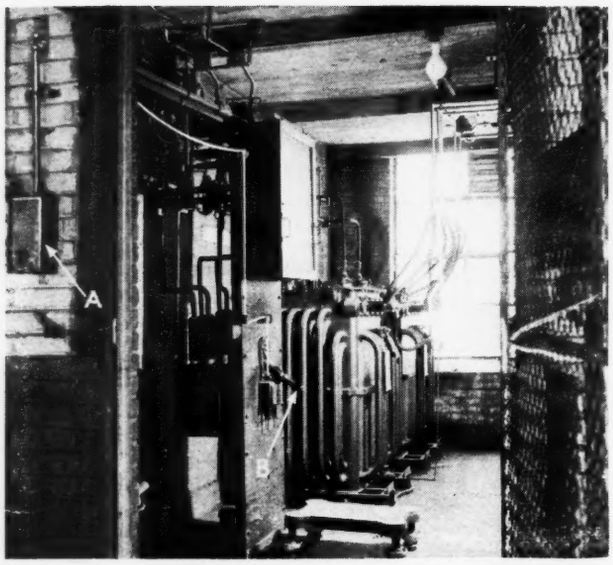


Fig. 3—Two modern 250-kva transformers in background. To black out plant without entering enclosure, open red box *A* and pull sash cord which runs to main switch *B*

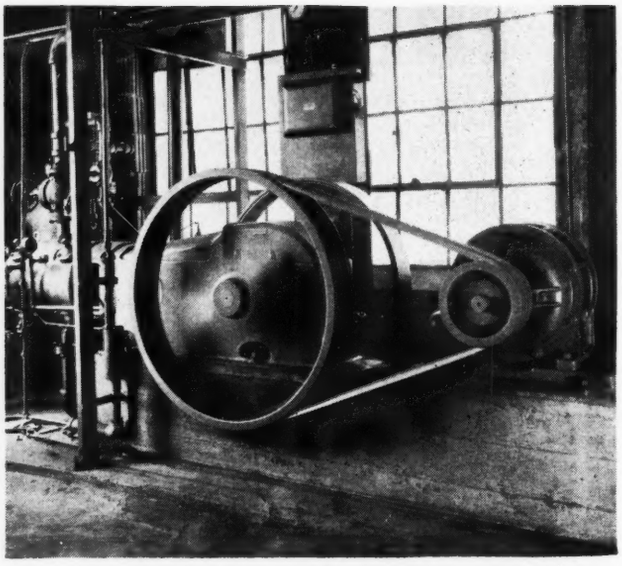


Fig. 4—Mercury switches automatically stop this compressor if cooling water fails or water pressure drops below a certain fraction of the main supply pressure

the time to fix equipment is *before* it breaks conflicted with established and comfortable habits. Moreover, some of the men felt that "preventive maintenance" would actually increase costs because it would mean doing "unnecessary things."

Fortunately, Lose has always been a practical man. The observable fact that he knew his job, plus his steady persistent pressure and the solid backing of Superintendent Case. has rebuilt the old maintenance gang into the maintenance organization pictured in Fig. 2—same men as before. but a new team spirit. Each man has a definite assigned responsibility which he handles with the aid of several assistants. Each has a rigid schedule.

The story of the accomplishments of this group can best be told in terms of the responsibilities and operations of each man. First. take electrical maintenance. which has had the mutual attention of Lose and Ed Coryell.

Electrical Maintenance

Like many other factories in the Tacony district of Philadelphia, L H Gilmer Co receives its power from the local utility as 2400-volt 2-phase 4-wire service. In expectation of increased loads from the national emergency, and to improve power factor and steady the secondary voltage, Lose replaced two old 150-kva transformers with modern single-phase, oil-insulated self-cooled 250-kva units, Fig. 3. Power distribution through the plant is at 220 volts 2 phase 4 wire. A grounded neutral gives 110 volts for lighting. Most of the motors operate on 220 volts but several 2400-volt 100-kw across-the-line units serve heavy process-machinery loads.

A rotary converter supplies direct current to motors requiring a wide range of speed control. Direct current is used also for dynamic braking circuits. Two sets of static condensers. connected to the secondary by remote control, insure a high power factor. checked several times daily.

Feeder Study Shows Savings

Gilmer's feeder study showed how savings could be made without hard-to-get new equipment. Loads were rearranged to improve voltages at motors without replacing existing cables. All compensators. line starters. etc, are inspected at regular intervals for bad contacts, loose connections and low oil. Replacement contactors are machined from bronze copper and silver soldered.

One man is responsible for the lubrication of all machinery. including motors. Thus all motors are constantly checked to prevent shutdown.

The entire plant is inspected daily by one man who replaces any lamps that may be burned out. He also washes all reflectors at least four times a year —more frequently where dusty conditions prevail. This continuous clean-up makes it possible, in some locations, to get equal illumination with lamps of lower wattage, thus effecting a saving in both power and lamp costs.

A motor-driven compressor rated 250 cfm at 125 psi produces the compressed air required in the plant. This unit now incorporates several home-devised improvements. For example. mercury switches (about $7 each) are so connected that the compressor will shut down if the cylinder cooling water fails or the water pressure drops below a certain fraction of main supply pressure.

Fig. 3 shows a blackout rig devised by Maintenance Superintendent Lose. Without entering the normally locked transformer room, any authorized employee can open the outside wall box (*A*) and pull the cord. This runs up through the wall and over a series of pulleys to the handle of the main switch (*B*). Box (*A*) is painted red for quick identification.

Maintains Special Machines

In line with the principle of individual responsibility, Lose has made Joseph Zeiske responsible for the carcass-building and cutting machines and for other special-machine parts.

The carcass equipment is a series of machines for building V-belts, the primary Gilmer product. Joe Zeiske inspects these machines twice daily and makes all minor repairs on the spot. Each weekend the machines are gone over thoroughly and all parts cleaned and repaired.

Watches Lab Equipment

Inspection and repair of the extensive laboratory equipment is the direct responsibility of Harry Mitchell. Many of the laboratory machines are built for the accelerated testing of products. and operate 168 hours a week. Formerly they were a constant source of trouble. but daily mechanical inspection has cured that.

Hank Mitchell tests all machines for oil. grease. hot bearings, etc. He checks them for broken parts; replaces or repairs them without delay. He adjusts sheaves and pulleys, and checks dyna-

mometers for flow. If a machine starts to hammer or vibrate he eliminates the condition before damage is done.

Since these daily inspections were started repairs and replacements of laboratory equipment have been greatly reduced and the running hours correspondingly increased.

Mechanical Maintenance

Some of Gilmer's most valuable money- and trouble-savers have come from Bill Hall's department—mechanical maintenance. Here are samples: The friction drive on the rubber calendar was a headache. The grip came from cast-iron friction plates alternating with disks of fibrous material. In three days slippage would burn or glaze the fibrous disks, forcing a shutdown for replacement. When redesigned using metallic disks, this drive gave no more trouble. The disks show little wear after eight months.

Another worth-while achievement of Hall's department was the solution of the gasket problem on the hydraulically operated steam presses used to cure molded rubber goods and belts. The service was severe; heat transmitted through the ram from the steam plate cooked the life out of the gasket. Dirt and foreign matter, picked up on the ram, were carried down to grind the gasket. The ram was hand oiled four times daily but spots were often missed. Gasket life averaged three weeks.

No cure was found for the heat transmission, but the other trouble sources were overcome by the design shown in Fig. 5 and 6. A piece of 1-in. channel iron was bent into a ring to fit around the ram. To this ring were welded three knee irons. A piece of felt was fitted inside the channel. After the ring was placed over the ram and bolted to the packing gland, the felt was saturated with oil. This rig insures equal lubrication and wipes all dirt and foreign matter from the ram before it can get into the gasket. It saves time in lubrication, and has increased gasket life four to six times.

With the present national stress on salvage, many POWER readers will be interested in the story of the steam-driven hydraulic pump. After long operation the ram and packing glands of this pump had worn until they did not hold the packing properly. This condition, in turn, wore the packing away rapidly. Rams were removed and ground true. The cast-iron packing glands were bored out and bronze bushed to bring them down to a bearing fit on the rams.

Doubled Packing Life

To make certain that the bushings would not hammer loose or become loose by heat expansion, the wall of the cast-iron gland was undercut and a bronze weld flowed in. This held the packing properly. The bearing fit of the gland on the ram gave it extra support, so that the packing did not have to carry the weight of the ram. These repairs doubled the life of the packing.

As an additional precaution Bill Hall assigned one man to grease and lubricate all machines throughout the plant. This man studies the action of the machines and reports for repairs anything that looks wrong, before serious damage is done.

The sandblast equipment, or "cabinet," uses steel grit as abrasive. To handle numerous minor breakdowns of this equipment a schedule of three daily inspections was established under Fred Keebler. Negligence of the operators was found to be the first source of trouble. When loading the machines with castings they did not remove foreign matter, so dirt would shut down the machine.

After the machine had been down for a while, moisture would condense in the air line and the operators would start it up without blowing it out. The water would then rust the grit and cake the passage. Reconstruction of the apparatus, plus precise instructions to operators, completely cured these troubles.

Sanitation, Steam and Water

The responsibility for sanitation, steam and water rests with Howard Keller. All rest rooms and washrooms are cleaned at least once a day, inspected twice a day, disinfected daily, and washed down with acid each month. Any leaks in pipes or spigots are immediately repaired.

To minimize steam losses, all steam-line valves, safety valves, and steam equipment are inspected and repaired weekly. The boiler is shut down three times a year for necessary repairs.

Right now, with increasing use of synthetic rubber in the product, water for cooling purposes is about the most important thing in the plant. Water supplied from a deepwell service pump is used for all purposes (except drinking and the boiler), after running through an aeration chain and filter bed. Fig. 7.

Because the water demand of the cooling system is steadily increasing, a closed drainage system has been connected to the water-cooled machinery in one part of the plant. Drained into a sump reservoir, this water is pumped

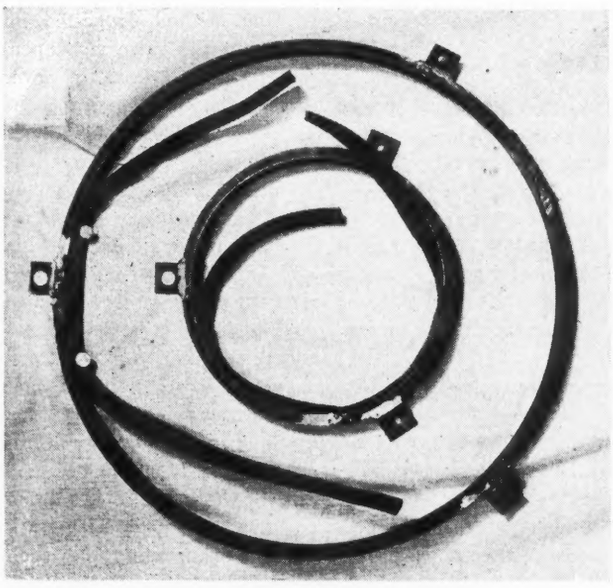


Fig. 5—Wiping rings for press rams increase gasket life

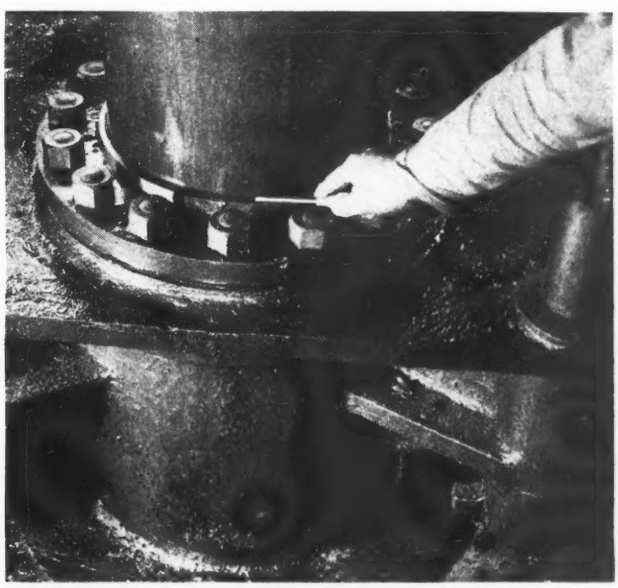


Fig. 6—Ring was applied to ram just above packing gland

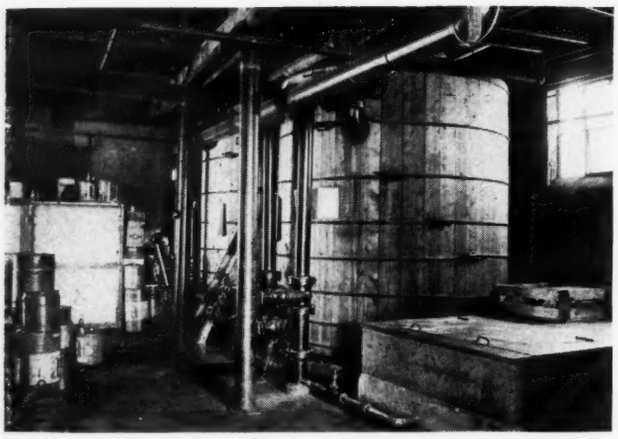


Fig. 7—The two filter beds and water-storage tank (right)

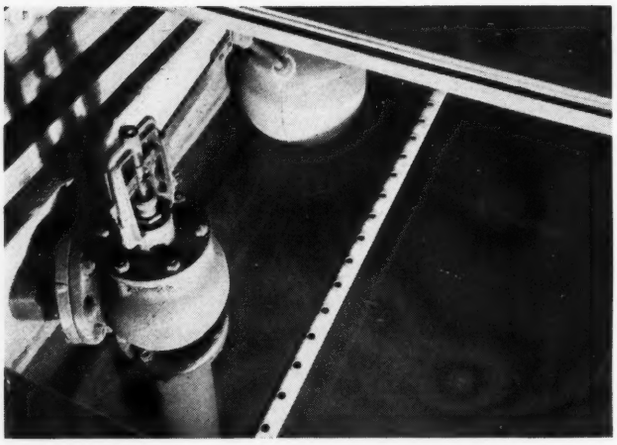


Fig. 8—Tank bottom shows clearly through filtered water

to the rest of the plant for double use.

Under present-day conditions it is practically impossible to get new parts in the usual manner. Therefore, it has been necessary for the men in Lose's department to design and make their own parts, such as bearings, clutches and similar items. In many cases these are made of scrap materials fabricated and welded together. Making sure that maintenance items are ready when needed (either by purchase or production on the spot) has been a major responsibility of Richard Craig, asst supt of maintenance.

Whenever repairs are required the machines are gone over carefully to find the best way to do the work. Before the actual work is started all necessary parts are lined up to avoid keeping machines idle any longer than absolutely needed to do the job.

These Gilmer savings and other achievements are not a finished story. Lose's maintenance gang is now a going concern, and will undoubtedly continue to unearth new savings throughout the plant.

In closing I wish to thank Mr John S Kraus, president of L H Gilmer Co, as well as Mr Case and Mr Lose, for opening the plant for inspection by this inquiring reporter.

Diesel Engineers Tell How to Operate under War Conditions

Repairing cracked cylinder heads, remelting babbitt for bearings and reconditioning of worn parts discussed at meeting

WITH NEW EQUIPMENT hard to get, diesel plants all over the country must work existing equipment at higher loads and for longer hours. Time lost for repairs and maintenance is more valuable than ever before, and in many cases spare parts cannot be obtained quickly, if at all. All this means that diesel-plant engineers must use every bit of ability and ingenuity they possess to keep their equipment rolling out the steady stream of kilowatthours needed for victory.

Practical operators and engineers representing equipment manufacturers shared their ideas and experience on this timely subject of operation under wartime conditions at a round-table session held during the 15th National Oil and Gas Power Conference, Peoria, June 17-19. The following is a summary of the ideas and suggestions presented; a full transcript of the discussion will appear as part of the conference proceedings to be published by the American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y. (available at $1.00 to members, $1.25 to others).

General pointers on operation given at the meeting stressed the need for closer and more frequent inspection of equipment and all-around better operation. Specific suggestions are summarized in the box on the facing page.

Much of the discussion centered around reconditioning of worn parts to save time and materials. Because of the amount of material involved repair of cracked cylinder heads is particularly important. One method suggested involves boring out the valve-cage opening and inserting a bushing to cover cracks between the valve-cage and the fuel-valve openings. These steel bushings are usually made in two parts, one at the bottom and the other at the top of the valve-cage opening. The lower part of the bushing should be rolled-in just like a boiler tube; if it comes loose it can be taken out and re-rolled. Cracked heads repaired in this manner have given satisfactory service for 6-8 years.

In some plants, cracked heads have been successfully repaired by welding. Experience indicates that many heads crack at the exhaust-valve opening and that just filling the crack and welding it doesn't get the job done. Usually it proves difficult to machine the shell where the valve seat rests, at least accurately enough to grind to a seat or

hold a gasket. In one plant where cracked heads are repaired by welding, a bushing is welded in place, giving new metal to machine off. Using a preheating furnace, it takes about a day to weld a head after it has been brought to proper temperature. The head must be welded slowly and should never be taken out of the fire. Means must be provided for moving the head so the welder can get at it. After welding, the furnace is closed and five to seven days allowed for cooling before the head can be removed and machined. It is often necessary to resurface the whole underneath side of the head.

In this plant, welding is done with cast-iron rods. Success seems to depend most on developing welders interested in doing a job that will stand up and in allowing plenty of time for the job.

This same plant has recently tried electric welding of cracked heads. Here again, time is important. Heat is applied to the head at two places to cause the crack to expand both ways. Using a $\frac{5}{32}$-in. soft-steel rod, the crack is partially filled and then peened while it is cooling. Alternate welding and peening is repeated until the crack is closed. The secret of success seems to lie in putting the weld under compression by expanding the head during welding enough so that when the head expands in operation the weld will never be under tension. Electric-welded heads require little machining, only the shelf for the gasket and a little grinding on the rim. Electric-welded heads have seen service for three years.

How to Avoid Cracks

Before spending time and trouble repairing cylinder-head cracks, steps should be taken to avoid the trouble. A principal cause of failure in 4-cycle engines is overtightening of valve stud bolts; resulting stress frequently causes heads to fail between either exhaust or intake valve and fuel valve. On both 2- and 4-cycle heads, overtightening head bolts can cause cracking. Experience indicates that such bolts are better under- rather than overtightened; leakage, if it occurs, can be checked easily.

Burned cylinder-head gaskets form another cause of failure. One operator reports eliminating use of cylinder-head gaskets by grinding valve seats directly into the head and also experimenting with using valves out of larger engines and eliminating the seat and valve cage. Grinding the valve directly on the inner side of the head reduces the need for tightening the valve studs and holding the valve against the seat. Engines equipped this way have run for several years without valve grinding, it was reported.

Another cause of cylinder-head failure is faulty water circulation. In some cases the original piping design is responsible; in others the fault lies with a re-piping job made without regard for circulation conditions. If cooling water enters the head at the same side the overflow comes from, bypassing will result and cause overheating.

With tin for babbitt short, considerable thought was given to bearings. Discussion brought out three important points. In the first place, operators should not throw away bearings that have developed minor cracks. Such conditions get worse uniformly and do not cause failure without ample warning. For example, if in 2000 hours 2% of the bearing surface develops minor cracks or even small broken-out areas, this will only grow to 4% in 4000 hours and 6% in 6000. This means that the progress of bearing deterioration can be forecast closely and there is no need to replace until the condition is severe.

Each year many thousands of bearings are thrown away because the surface is discolored. Such discolorations, in most cases, can be cleaned up and the bearing will continue to give good service. The important point is to determine the cause of discoloration and try to stop it.

Remelting, if carefully done, makes babbitt from old bearings useful for repair and maintenance work. The important thing is not to contaminate it in remelting. A pure tin-base babbitt is seriously contaminated if the lead content exceeds about 2% and lead-base babbitts are almost equally sensitive to contamination.

One engineer reported that valve stems from a large 4-cycle engine had been turned down to make stems for a smaller engine, thus saving steel. This same idea may be applied to fuel needles and fuel-pump plungers.

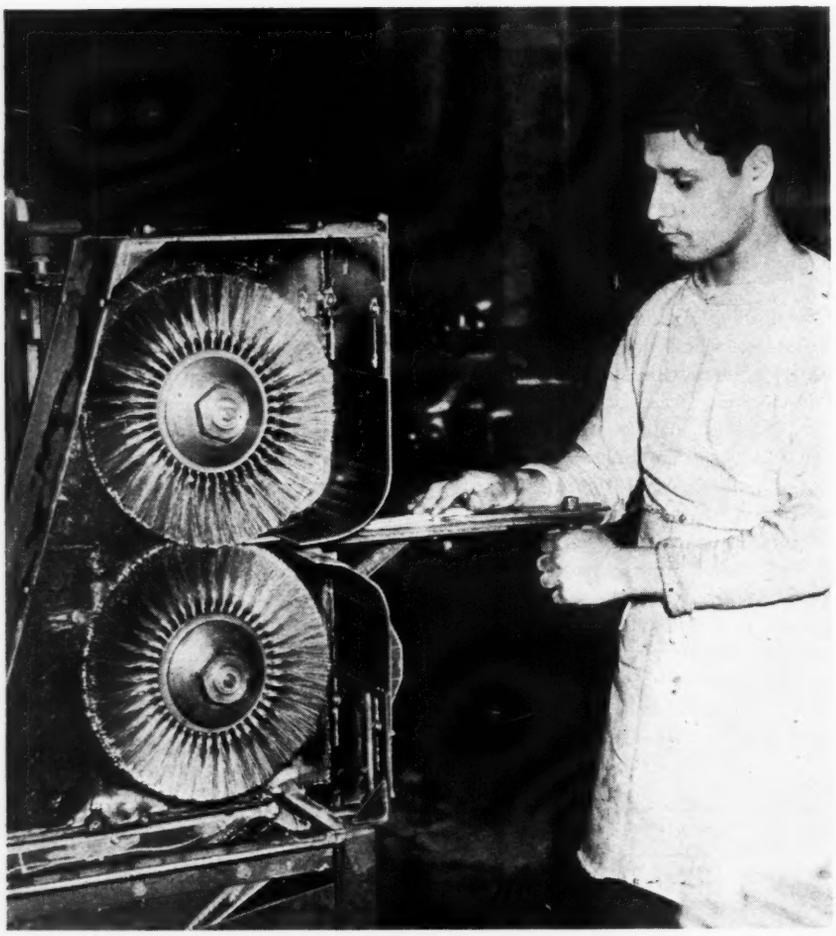
Many plants replace connecting-rod bolts after a certain number of hours of operation, but under present conditions this practice may have to be abandoned. Engineers at the meeting pointed out that most failures result from overtightening or uneven stressing and that if stress is kept below the fatigue limit the bolts should last indefinitely. If bolts have run 30-40,000 hours and if examination shows no signs or scuffing or actual damage, they can be put back into service. If replaced at the same bolt tension as before they should perform satisfactorily.

SIX STEPS TO BETTER DIESEL OPERATION

Discussing the problem of operation and maintenance under wartime conditions, diesel engineers and operators at the 15th National Oil and Gas Power Conference made a number of good suggestions for keeping units on the line when every kilowatt-hour is needed. These boil down to six general points:

1. **Inspect** engines and auxiliaries more frequently, particularly crankshafts, main bearings, connecting-rod bolts, pistons, and rings. Systematic periodic inspection catches trouble in its early stages
2. **Adjust** engines and auxiliaries more frequently to keep them in better operating condition
3. **Maintain** lubricating oil in good condition to hold wear of engine parts to a minimum and treat cooling water scientifically to avoid dangerous scale formations that may crack cylinder heads
4. **Avoid** high ratings and overloads wherever possible
5. **Make** engine repairs promptly—don't wait for serious trouble to develop
6. **Anticipate** spare-part needs and order as far ahead as possible to give manufacturers some leeway in making delivery. Be sure to get the proper priority rating

PRACTICAL AIDS TO OPERATION



Brushes Remove Armature-Coil-Lead Insulation

REMOVING INSULATION from the ends of armature-coil leads before putting them in the commutator is quite a chore under the most favorable conditions, but when the insulation is hard asbestos it is a real job. Faced with this problem in its armature-winding department, the Elwell-Parker Co. Cleveland, Ohio, installed power-driven steel brushes to do the job, as in the photo.

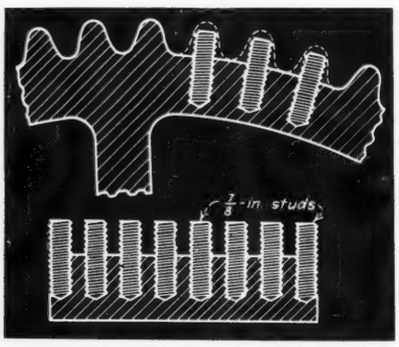
As shown, the insulated coil leads are shoved along a small metal shelf through a gaged slot which holds them tight against the action of the speeding brushes. Rotating at a peripheral speed of 10,000 fpm, the brushes quickly whisk the insulation off the wires when they contact. Experience has shown that the brushes clean the lead in about one-half the time required by hand and do a better job without injury to the conductors.

Cleveland, Ohio G O ROWLAND
Osborne Mfg Co

New Gear Teeth With Bronze Welding

WHEN THREE TEETH BROKE off a 72-in. cast-iron bull gear on one of our rubber mills we had the job of getting the machine into service again quickly without the delay required for a new gear. We chiseled off what remained of the old teeth, down to the roots, to get a comparatively smooth surface on the wheel. Along the center line of broken teeth across the gear face we bored and tapped holes for $\frac{7}{8}$-in. studs, about $\frac{7}{8}$ in. deep. Cap screws were used for studs, care being taken to jam them tightly against the bottom of the holes, after which they were cut off to slightly below the height of the gear teeth they were to replace.

When this job was completed we preheated a large part of the gear with the gas torch to prevent excessive stresses being produced when the bronze welding rod was deposited to form the teeth. The bronze was first applied at a high enough temperature so that it formed a good bond between the cast iron and studs, after which the teeth were built up on the studs. After the welding was completed we covered the gear with asbestos so that it would cool slowly and excessive stresses would not be set up in it while it was cooling. When it became cool we ground the teeth to shape and finished them with a smooth file. The gear is now running



two shifts per day and we hope will continue to do so until we can get a new gear.

Cleveland, Ohio A R CIOTTI

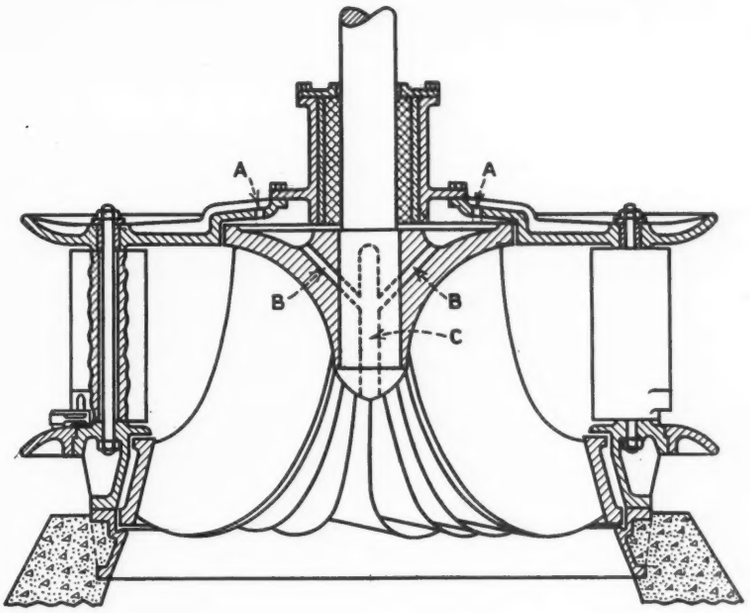
Air Admission Increases Hydro-Turbine Power

WE OPERATE A HYDROELECTRIC PLANT in parallel with our steam plant, but during about two-thirds of each year we experience a water shortage for the hydro plant. This plant has one 800-hp francis wheel direct-connected to a 625-kva 0.80-pf ac generator, which connects with the local utility company at our switchboard. The turbine operates under a 27-ft head on water supplied through a 1300-ft penstock. A float-actuated selsyn motor at the dam

actuates the turbine gates so as to utilize the flow of the river continuously during dry periods.

To start the wheel and bring it up to synchronizing speed required 75 cfs of water. Having read at one time something about increasing the power of a waterwheel by admitting air to it during part-gate operation, I decided to see what could be done with our wheel. The problem was to apply the air where it would do the most good. Looking at a blueprint of the wheel I found that the shaft was drilled from the lower end up to near the top of the hub as at *C* in the figure.

In my way of reasoning to a solution of the problem I decided that the best place to admit the air would be into the center of the draft tube. Doing this at low flows would tend to keep the water to outer periphery of the wheel where it would have the greatest turning effect and therefore develop the most power. So working on this theory we bored and tapped two 1½-in. holes in the turbine cover plate as at *A*. We also drilled two 1½-in. diagonal holes *B* through the runner hub and shaft to connect with the center hole. A pipe with a valve was threaded into the holes in the cover plate to control air flow to the turbine.



After some experimenting we found only one of the air connections was required, so removed the other and plugged the hole in the cover plate. We have found on our unit that admission of air begins to increase the power of the turbine at 35% gate opening, with the greatest increase occurring at 17.5% gate opening. This is the opening required to bring the wheel up to synchronizing speed without air, but with air admission to the draft tube the unit will generate 80 kw. Without air the unit requires 75 cfs to bring it up to speed but with air 25 cfs is sufficient.

There was only one day last summer when the flow was down to 25 cfs, at which point we were unable to operate the wheel. Most of the time we were operating at about 10% gate opening and carrying about 50 kw load. Without the air we would have been unable to generate any power a good part of the time in the summer months. This gives an idea what can be done by admitting air to a hydro turbine operated at small gate openings.

Claremont, N.H. I F RICHMOND

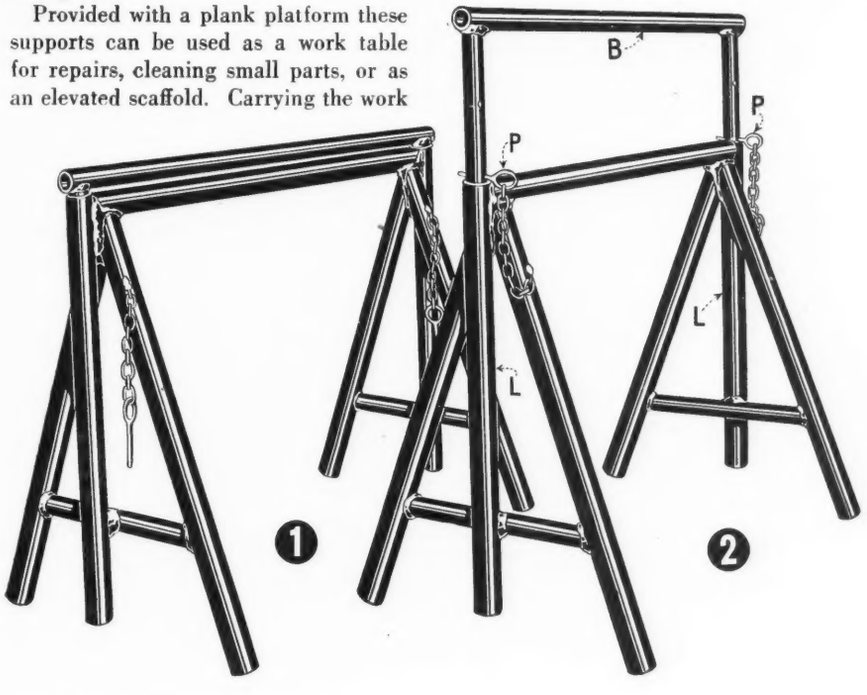
Welded Pipe Structures Form Platform Support

A TIME-SAVING PLATFORM SUPPORT constructed from pipe by welding provides a portable device for use on many repair jobs in a large hydro plant. The top crossbar *B* is welded to two vertical legs that telescope into vertical pipe sections *L* welded to a base structure. In Fig. 1 the top section is shown at its lowest level, but can be adjusted to different levels and held there by pins *P* through holes in the vertical legs, as in Fig. 2.

Provided with a plank platform these supports can be used as a work table for repairs, cleaning small parts, or as an elevated scaffold. Carrying the work table to the job saves the time usually consumed in carrying machine parts to and from the shop for cleaning and repairs.

The diagrams illustrate the welded construction and the adjustable arrangements on the crossbar. Leg spread of each trestle must be great enough to prevent overturning when the crossbar is fully raised.

Chicago, Ill. J B MULLINS

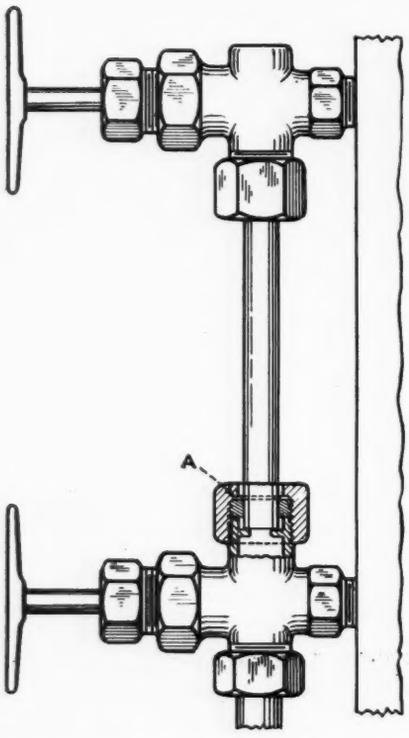


⅝-In. Gage Glass Replaces ¾-in. Unit

IN THESE DAYS OF PRIORITIES and other restrictions on getting supplies, engineers must use their wits to keep the plant going. One day a ¾-in. gage glass blew and when we checked up on supplies I found we had only a ⅝-in. size in stock. As it would have taken some time to get the correct size,

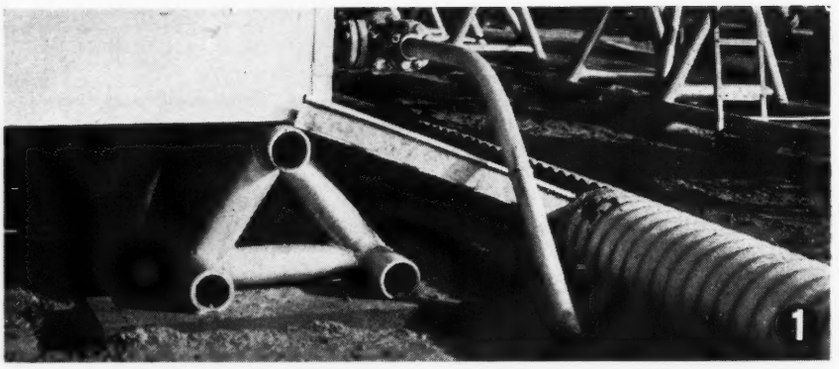
I decided to use the 5/8-in. one. To do this I put a piece of 1-in. round brass in the lathe, and made two thin washers that fit closely around the 5/8-in. glass and would go into the packing nuts, as shown at *A* in the diagram.

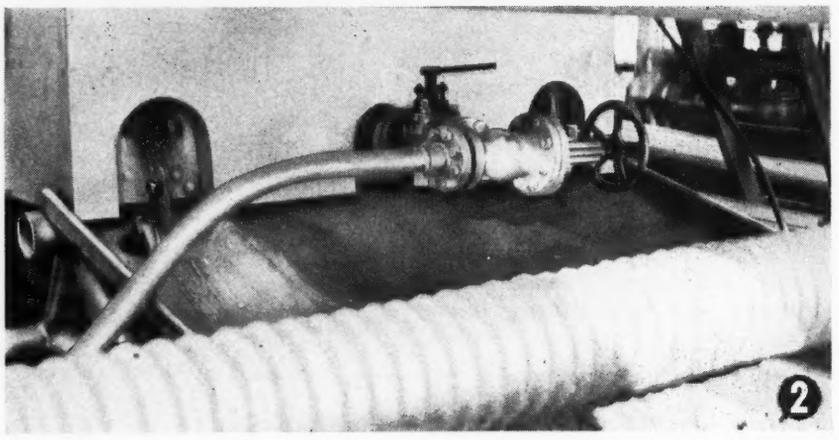
I put one of these washers into each packing nut to form a false bottom and then installed the glass in the normal way. When the nuts were tightened on the packing it made a perfectly tight joint so we did not have to install a 3/4-in. glass when we got some in stock. Some years ago I did a similar job on a low-pressure boiler, but in that case I used a piece of string solder to form



a ring around the glass to fill the space between it and the side of the hole in the nut.

Riverdale, N. Y. ALEX GRAY





Disposal Flume for Boiler Wash Water

OPERATING STEAM BOILERS in oil fields presents several problems not usually found in stationary plants. Even though some of these plants are of considerable size they are temporary installations. Usually the feedwater is poor and, when treated in the boiler, requires frequent blowing down and washing of sludge and scale from the mud-ring handholes. In many of these plants blowdown and wash water is allowed to run where it will, but the operators of one plant decided that a temporary plant could be just as neat and clean as a stationary installation, and disposed of waste water where it would not be a nuisance.

These boilers are supported on triangular welded pipe structures resting on timber mats laid directly on the ground, Fig. 1. When the boilers were installed a light corrugated pipe was run about 4 ft from their rear ends and an opening cut into the pipe the width of each boiler. A flat sheet-iron apron was then run from under the rear of each boiler into a slot in the pipe, Figs. 1 and 2. All wash water from the boilers drains into the pipe, which is led to the most convenient place for water disposal where it will not create a nuisance.

Santa Monica, Calif. J C ALBRIGHT

Put Telltale Marks on Circuit Fuses

TO KEEP THE RIGHT SIZE fuses in circuits is sometimes quite a problem, either because a fuse is a fuse to a machine operator, or because somebody is careless in the electrical department. Usually it is advisable to have the machine operators practice a hands-off policy and call the electrician to replace a fuse if one blows. In this case the electrician may not have the right size fuse with him when he arrives on the job, unless the machine operator can give the electrician this information when he calls him.

We have overcome all the little annoyances with fuses in our plant by a fuse identification method, which involves painting a ring of color around each fuse casing near one of the ferrules. Then, when a fuse blows it is a simple matter for the machine operator to tell the electrician the color of the ring on the fuse when he calls him. This color scheme is as follows on cartridge fuses:

Near one ferrule on each 5-amp fuse we paint a white ring; on 10-amp a yellow ring; on 15-amp. a green ring; on 20-amp, a red ring; on 25-amp, a blue ring, and on 30-amp, a black ring. We follow the same plan for the 31- to 60-amp fuses. A spot of the same color is painted on the outside of the switch-box cover, so that even though the machine operator cannot see the fuses he can give the electrician the color.

The color scheme also serves to insure that the correct size of fuses are used in the circuit. A fuse of one capacity and one of another cannot be used without the fault being easily de-

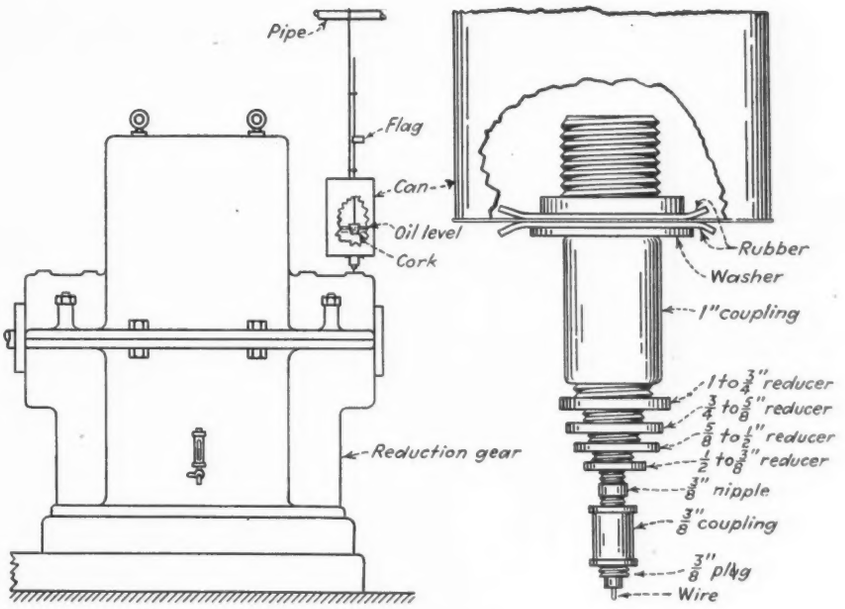
tected by the difference in color bands. Then, too, even if a complete set of larger fuses were substituted for the original size, this would be detected by the difference in the color of the fuse bands and the identification mark on the switch-box cover. Where renewable fuses are used care must be taken to put the right-sized fuse wire into each casing according to its color ring.

Philadelphia, Pa. R O SPENCER

Emergency Lubricator Keeps Pump Running

WHEN A BROKEN OIL RING on the high-speed shaft of a reduction gear driving a condenser pump was discovered, the bearing was already hot. Oil was slowly poured in the inspection hole until our assistant chief could find a remedy. He soon returned with the queer gadget shown in the diagram.

He had removed the top from a clean oil can and punched a 1-in. hole in the bottom. Through this he placed a 1-in. close nipple bushed on both sides with rubber packing. A 1¼- to 1-in. reducing bushing was screwed to the nipple inside the can and a washer and 1-in. coupling tightened the rubber packing on the outside. Next he reduced the opening down to ⅜ in. as indicated. A ⅜-in. nipple and coupling were next added and a ⅜-in. plug with a ⅛-in. hole drilled through. A piece of wire was hung in this hole to reduce the oil flow. This makeshift lubricator was hung over the bearing.



The can held enough oil to last about 45 min. but the oil level could not be seen from the operating floor. A thermos-bottle cork was attached to a wire run through guides, as in the diagram. A flag of adhesive tape was attached to this, making a level indicator visible from above. Oil was drained from the well in the gear base and reused.

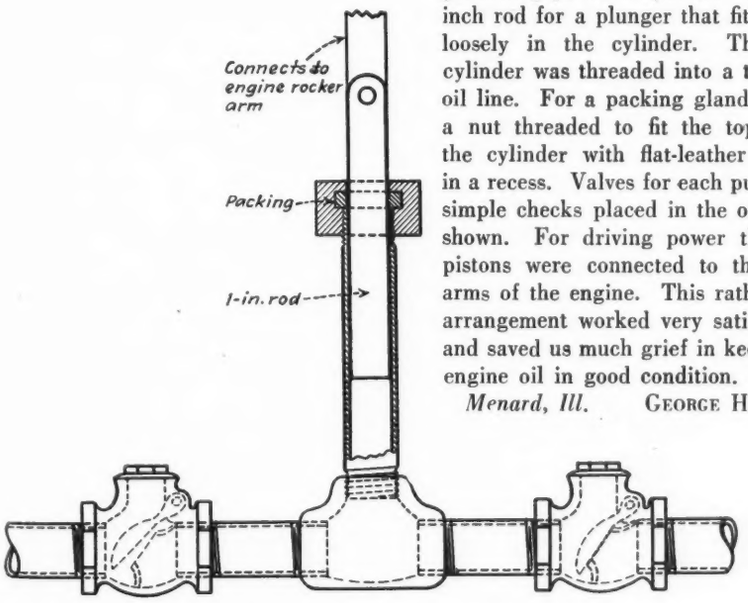
Manchester, N. H. CHARLES E FOSTER

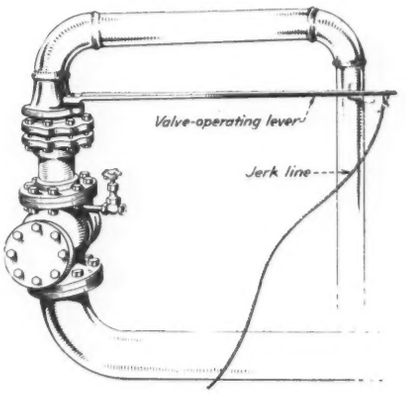
Homemade Pump Solves Lubrication Problem

SOME YEARS AGO I operated a cross-compound engine that was splash lubricated. Since we did not have an oil-circulating pump, the oil was drained from the crankcase periodically and filtered. Because of lint from a nearby manufacturing plant, oil changes were required frequently and cleaning the crankcase was a problem. The management would not purchase a circulating system so I proceeded to build one, using pipe for oil lines and an oil drum for a filter.

To circulate the oil I made two pumps like the one shown in the diagram. Each pump consisted of a short piece of pipe for a cylinder and a one-inch rod for a plunger that fitted quite loosely in the cylinder. The pump cylinder was threaded into a tee in the oil line. For a packing gland we used a nut threaded to fit the top end of the cylinder with flat-leather packing in a recess. Valves for each pump were simple checks placed in the oil line as shown. For driving power the pump pistons were connected to the rocker arms of the engine. This rather crude arrangement worked very satisfactorily and saved us much grief in keeping the engine oil in good condition.

Menard, Ill. GEORGE HOLMAN





Valve-Handle Support Prevents Rapid Wear

A QUARTER-TURN quick-closing valve was installed ahead of the throttle valve, to permit emergency engine shutdown by pulling on a jerk line. This valve had quite a long lever which, as a result of piping vibration, caused the valve stem to wear. To overcome this difficulty, we lengthened the lever by welding so that it reached a vertical pipe. We then welded a rest for the lever on the pipe, as in the figure. Now the valve stem lasts longer than the valve parts.

Houston, Texas CHARLES C. LYNDE

How to Figure Beams—No. 3

By PHIL SWAIN

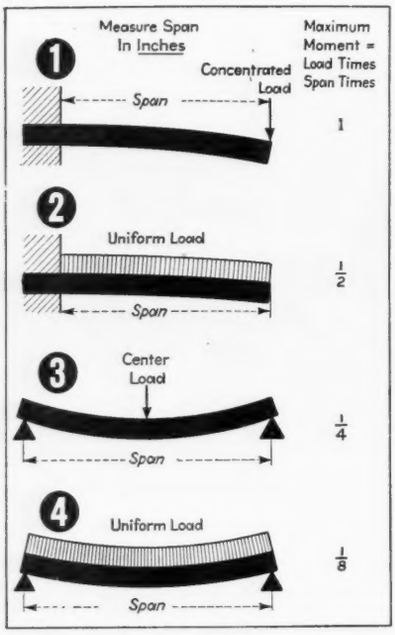


Fig. 1 & 2—Cantilever beams
Fig. 3 & 4—Simple beams

FOR REFERENCE, and for further practice, here is a condensed table showing the *section modulus, S* (that is, the "shape strength") of "American Standard" steel I-beams ranging from three to twelve inches deep—also rules for the maximum bending moments in the common cases shown in Fig. 1, 2, 3 and 4. This maximum moment ranges from the simple product of the load by the span in Fig. 1 to one-eighth that product in Fig. 4. In these beam problems *spans* are always measured in inches.

At any section along a beam the applied bending moment created by the loading equals the resisting bending moment of the section. This resisting moment involves both *material* and *shape* of the section; it is the product of the section modulus and the unit stress in the material.

For example, consider an 8-in. American Standard beam weighing 20.5 lb per ft. The table gives 15.1 for the section modulus. Therefore if the metal is stressed to 10,000 psi the section can resist a moment of 15.1 × 10.000 = 151,000 inch pounds.

Next imagine that this beam is rigged as a cantilever (Fig. 1) projecting 50 in. from the wall with a concentrated load of 3,000 lb at the end. Then the maximum bending moment will occur at the wall and will be 3000 × 50 = 150.000 inch pounds. This practically balances the other 151,000 inch-pound moment just computed, which means that a 3000-lb load at the end of a 50 in. cantilever will produce a unit stress of about 10.000 psi in the section at the wall if the beam is an 8-in. American Standard weighing 20.5 lb per ft.

For steady loads most building codes now permit a maximum unit stress of 20,000 psi in bending. ["How to Figure Beams—No. 2" said 18.000 psi, but 20.000 psi is now being widely adopted. —Editor.]

The previous problem took no account of the weight of the beam, which is part of the load. Beam weight can be safely neglected in this case because it is less than 100 lb for the whole length of the beam.

In some problems, however, the weight of the beam will be an appreciable factor. This will occur chiefly in cases where the beam is slender—that is, long in comparison with its section.

With a slender beam another problem enters. If it is not protected against side movement by occasional braces, the compression flange may fail by buckling at a lower stress than would cause failure of a shorter beam. Thus all codes reduce the permissible unit stress for slender beams. The *slenderness ratio* for an I-beam is the length of the unbraced span divided by the *width* of the flange. Thus a flange width of 5 in. and an unsupported span of 175 in. give a slenderness ratio of 175 ÷ 5 = 35. Most codes do not permit any slenderness ratio higher than 40 for simple beams (supported at both ends) and penalize ratios over 15 by deducting about 1.5% from the permissible unit stress for each *point* of ratio over 15.

Now let's apply these rules to determine what *uniform load* may be placed on a simple beam (Fig. 4) with a span of 175 inches (14.6 ft) if the beam is a 12-in. American Standard I-beam, weighing 31.8 lb per ft.

The slenderness ratio is 35. This is below the maximum limit of 40, but exceeds the penalty limit of 15 by 20 points. Allowing 1.5% for every point over 15, we must knock off 20 × 1.5 = 30% from the normal maximum unit stress. Assuming this to be 20,000 psi, the beam should be designed for a unit stress not exceeding 0.7 × 20,000 = 14.000 psi. Let W equal the total load, including the weight of the beam. Then, from Fig. 4, we see that

$$W \times 175 \times \tfrac{1}{8} = 36.0 \times 14{,}000$$

This reduces as follows

$$W = 504{,}000 \div 21.9 = 23{,}000 \text{ lb.}$$

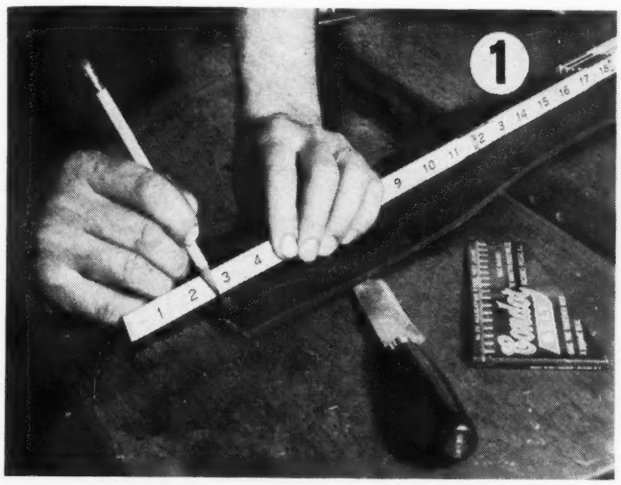
Weight of the beam will be 31.8 × 14.6 = 500 pounds, approximately. Deducting this, the safe live load on the beam will be 22.500 pounds.

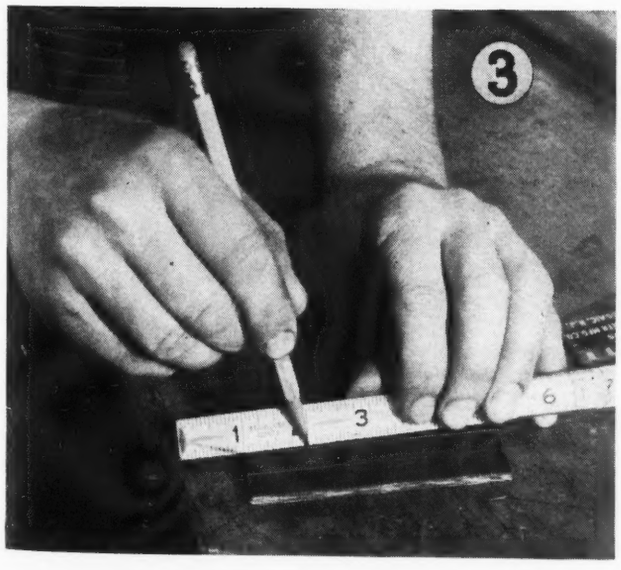
AMERICAN STANDARD BEAMS

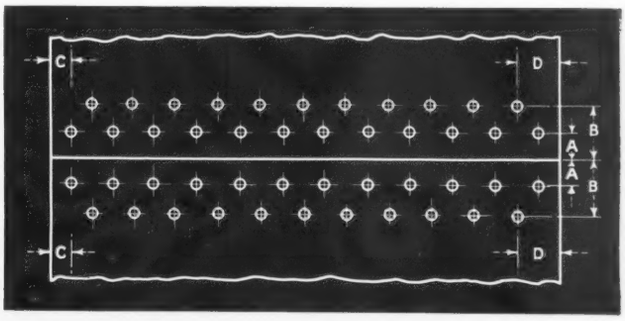
Depth, in.	Nominal width, in.	Weight per ft, lb	Section Modulus
12	5¼	55.0	53.2
		50.0	50.3
		45.0	47.3
		40.8	44.8
12	5	35.0	37.8
		31.8	36.0
10	4⅝	40.0	31.6
		35.0	29.2
		30.0	26.7
		25.4	24.4
8	4	25.5	17.0
		23.0	16.0
		20.5	15.1
		18.4	14.2
7	3⅝	20.0	12.0
		17.5	11.1
		15.3	10.4
6	3⅜	17.25	8.7
		14.75	7.9
		12.5	7.3
5	3	14.75	6.0
		12.25	5.4
		10.0	4.8
4	2⅝	10.5	3.5
		9.5	3.3
		8.5	3.2
		7.7	3.0
3	2⅜	7.5	1.9
		6.5	1.8
		5.7	1.7

HOW TO LAY OUT HOLES IN BELTS

WHEN the ends of flat belts are joined by lacing or other fasteners, it is necessary to punch one or more rows of holes across the belt ends. The efficiency of the connection and the life of the belt depend to a large degree on how carefully the holes are located and punched. First, cut the ends of the belt square as explained on page 117, August POWER. *Photos taken with cooperation of Manhattan Rubber Mfg Div, Raybestos-Manhattan.*







Values Corresponding to Dimensions Indicated in Diagram (inches)

Belt Width	*A*	*B*	*C*	*D*	*Lacing Width*
2 to 4	½	1	½	1	¼
6 to 8	⅝	1¼	⅝	1¼	5/16
10 to 12	¾	1½	¾	1½	⅜
14 to 16	⅞	1¾	⅞	1¾	½
18 to 20	1	2	1	2	⅝
22 to 24	1¼	2½	1¼	2½	⅝

1 To lay out the lacing holes, first measure back distances from the ends of the belt as indicated by *A* and *B* in the diagram and table. For example, if the belt is 8-in. wide, the first rows of holes *A* should be ⅝ in. from the ends of the belt and the second rows 1¼ in. from the ends. Mark the location of each row of holes.

2 With a carpenter's square or a belt square, draw a pencil line across the belt where the rows of holes are to be punched. If you have any doubt about the edges of the belt being straight draw a line with the square against each side of the belt and see if the lines coincide. If they don't coincide, the belt edges are not straight. In this case, measure back from the belt ends at each edge, to determine the hole lines.

3 After drawing the lines across the belt for the rows of holes, carefully locate the position of the holes on the lines. First locate the *C* holes in the end rows and divide the space between these holes in equal parts approximating distance *D* in the table. After the row *A* holes have been located, position the row *B* holes on their line midway between row *A* holes, as shown in the diagram. If the job is done correctly, when the two ends of the belt are placed squarely together, each hole in one end of the belt will be directly opposite its corresponding hole in the other end. Lace holes should be punched only large enough to admit the lacing with difficulty, not over ¾ the lace width given in the table. On the pulley side of the belt the lace should run parallel with the length of the belt.

READERS' PROBLEMS

Questions from Our Readers

Ammonia Brine-Cooler Tubes

Question 1

WE MUST RETUBE OUR AMMONIA BRINE COOLER *with charcoal-iron tubes, as steel ones are not available. After receiving several recommendations on this material we have decided to go ahead with the retubing. However, I am still concerned about what effect the ammonia will have on these tubes and whether they will stand up as well as those made from steel.*

We use calcium-chloride brine. Ammonia suction pressure is 10-30 psi, and the brine temperature varies from 0 to 10 F. The cooler has 80 tubes 2 in. in diameter by 16 ft long.—PCJ.

High-Pressure-Pump Trouble

Question 2

SOME TIME AGO *one of our steam-turbine-driven boiler-feed pumps was damaged when we started it with the suction valve closed. Suction pressure is 250 psi and the pumps operate at 950 psi for boiler-feed supply. Although equipped with the usual governor and overspeed device, which operated on the trouble mentioned above, the pump was damaged before it could be stopped. How can we protect our pumps against this trouble yet have assurance that shutdown would not occur on a slight drop in suction pressure?*—GLK.

What's Wrong with This Engine?

Answers to July Question 1

The Question

THESE INDICATOR DIAGRAMS *were taken from a tandem-compound double-eccentric releasing engine. They were taken at 270-hp load, steam pressure 150 psi, receiver pressure 25 psi, and exhaust pressure 4 psi. An 80-lb spring was used on the high and a 10-lb spring on the low-pressure cylinder. The high-pressure cylinder is 15 in. in diameter and the low-pressure 30 in. with a 36-in. stroke operating at 104 rpm.*

What is the best procedure to follow in correcting the valve settings? What is causing the loops and hump in the exhaust line of the low pressure cylinder?—GIW

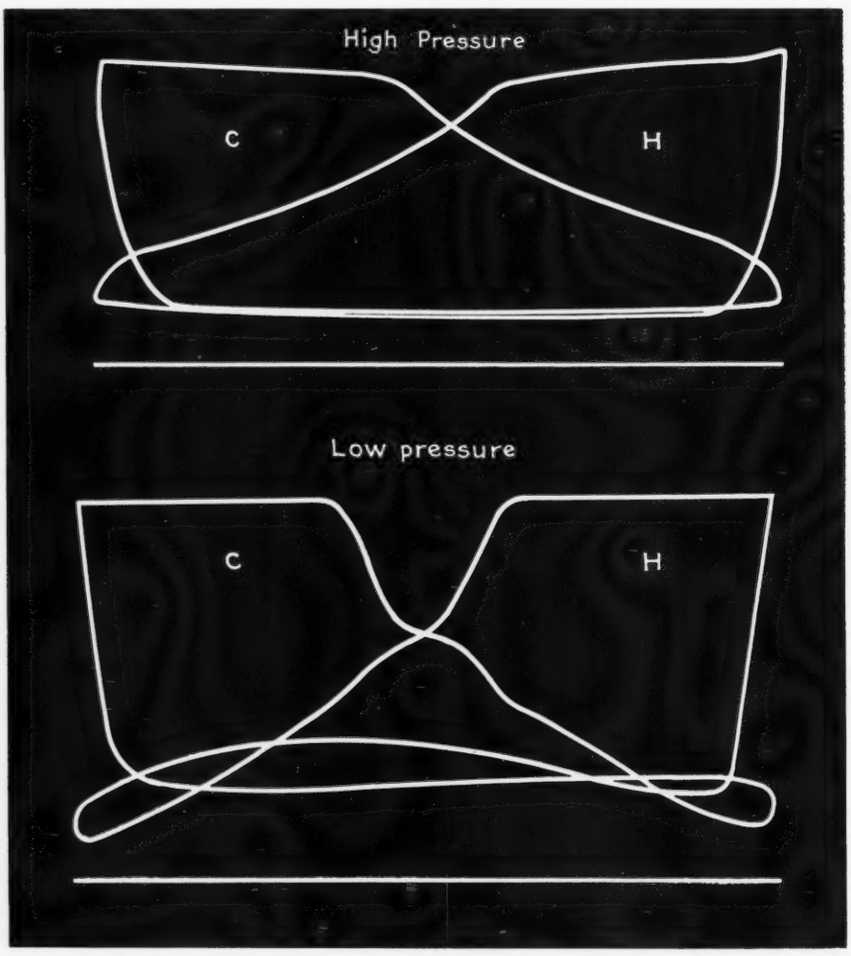
Causes Considerable Power Loss

EXCEPT FOR LATE ADMISSION at the crank end, GIW's h-p cylinder operates almost perfectly. The exact reverse is true of the 1-p cylinder, where early cutoff is responsible for the negative work areas at the ends of both strokes. Readmission caused by rolling or otherwise momentarily leaking steam valves causes a small hump in each expansion line. A head-end exhaust valve, only partly opened, throttles the escaping steam so that there is a rise in exhaust pressure, as shown by the hump.

A good way to make an indicator card understandable is to superimpose it upon a diagram of the cylinder drawn to the same length, see the accompanying sketches, page 124. The top of the cylinder is drawn even with the steam lines, and the bottom even with the atmospheric line. By drawing both steam and exhaust valves in the diagram, the relationship of valve motion to piston movement and to lines drawn by the indicator pencil can be made reasonably plain and simple.

By applying this system to the diagram from GIW's 1-p cylinder, it is at once apparent that there is nothing wrong with the engine, as the piston, with approximately 16 psi behind it and 4 psi before it, moves from the end of the cylinder *a* to the point of cutoff *b* of the forward stroke, Fig. 1. Here the head-end steam valve *B* which, as shown by the level steam line, has been wide open, closes the port, and expansion begins. The horizontal exhaust line *z-y* shows that the crank-end ex-

(*Continued on page* 124)



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Every moment of delay, every extra and unnecessary machining, assembling and installation operation, every unnecessary interruption to vital production, every diversion of manpower from production to maintenance now assume tremendous importance. They must be eliminated. That is why men responsible for the fate of America's production effort are turning to Unitrol . . . the modern and better way of housing, installing and centralizing Motor Control.

Whether it's Motor Control for a single machine or Motor Control for an entire factory, Unitrol makes the task of its installation, servicing, change, extension or contraction so much easier that plant after plant is adopting Unitrol.

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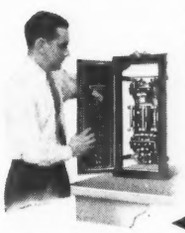
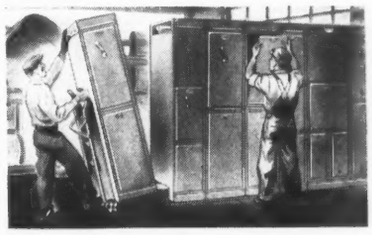
1892—1942 50TH ANNIVERSARY

Unitrol is a *better* method of mounting, housing and *centralizing* Motor Control . . . from the individual unit up to the complete plant-serving motor control center. It is made up from standardized interchangeable parts. It is complete and usable at every step of the way. It is inexpensive, speedy and easy to install, demount or change. It is as "flexible as a rubber band."



The individual Unitrol *Section* houses Motor Control for several motors or motorized machines, is compact, space-saving, convenient and economical. No supports, no other structures or preparation necessary.

← The individual Unitrol mounting frame is *better* for machines with built-in Motor Control. It eliminates many machining, wiring and assembling operations.



The complete Unitrol Control Center houses all the control and control equipment in the plant, for easy, speedy man-power-saving installation, maintenance, change, expansion or curtailment. No wall or floor preparation. No racks, trellises or frames. Permits installation of more than double as much control in same space.

CUTLER-HAMMER
UNITROL
C-H

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(Continued from page 122)

haust valve is wide open with port clear.

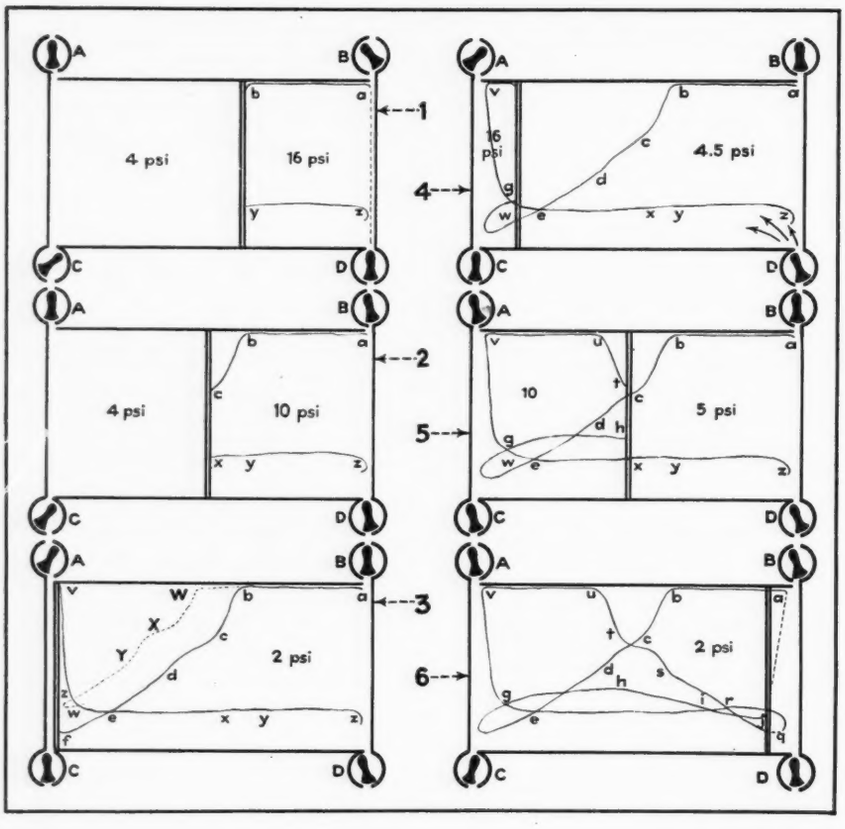
Expansion is normal until the piston reaches the midway point of the stroke, Fig. 2. As the last half of the stroke begins, a hump, Fig. 3, appears in the expansion curve which can be accounted for in two ways: Blowby of steam from the h-p cylinder, caused by a scored or corroded rod, or readmission of steam caused by the steam valve *B* either rolling or lifting, or admission of steam past a scored or flat place on the valve. As the piston completes the stroke it will be noted, Fig. 3, that the steam behind the piston has expanded to 2 psi lower than the 4 psi backpressure. From the point *e*, where the head-end expansion curve crosses the exhaust line, to the point *f*, where the head-end exhaust valve opens for release, the h-p cylinder and the inertia of the flywheel must not only carry the engine load but must also push the 30-in. piston against the higher pressure, even before compression begins.

This makes most engines pound. Opening of the exhaust valve *D* does not release the pressure in the cylinder; instead, steam flows into the cylinder from the exhaust line, and the curve turns upward to complete the loop. Unless valve *D* is a snug fit, it may lift and clatter. The remedy for this is to delay the cutoff. Had the cutoff taken place later in the stroke, say at *W* instead of *b*, Fig. 3, expansion would have followed the dotted line *W-X-Y-Z* very closely, and the pressure in the cylinder would not have fallen below backpressure.

Fig. 4 shows the piston starting on the return stroke. Instead of being level, the head-end exhaust line rises above the 4-psi backpressure line. There are four possible causes of this: Blowby past the piston rings or along the rod from the h-p cylinder; leakage through steam valve *B*; or exhaust valve *D* open insufficiently to let the steam escape as fast as the returning piston compresses it. This last is highly probable, for compression is greater as the piston gains speed toward the middle of the stroke, Fig. 5, and falls off as the piston slows down toward the head end, as shown in Fig. 6.

Adjusting the steam valves for later cutoff will iron out these loops and give the engine more power. Likewise, adjusting the head-end exhaust valve *D* to clear the port will give the engine still more power. Regarding the hump in the expansion line, a valve may be kept from rolling by any method which will hold it to its seat; copper plugs hammered into holes drilled in the top of the valve near the ends often proves an effective and practical solution.

Menard, Ill. GEORGE HOLMAN



Increase Receiver Pressure

GIW HAS A BAD LOOKING situation, but one that can be corrected if he is willing to experiment with his valve settings.

The h-p diagram shows fairly good valve setting and performance except that the cutoff on the crank end is slightly later than that of the head end. The 1-p diagram, however, shows that conditions are far from perfect. Admission is too early, especially on the head end, and the cutoff is slightly later on the head end than on the crank end. The humps in the expansion lines are evidently caused by whipping of the indicator cord caused by a sticking drum or by dirt on the indicator piston. The main trouble, however, is that after cutoff the steam in the 1-p cylinder is expanded to below backpressure, as indicated by the exhaust loops extending below the backpressure line. The crankend exhaust valve opening is restricted as shown by the height of the backpressure line.

Using the ordinate method to arrive at the mep of each diagram it is evident that the h-p cylinder is carrying most of the load. I would suggest that GIW make adjustments for an earlier cut-off on the steam valves on both cylinders. This will cut down the output of the h-p cylinder. The cutoff on the 1-p cylinder would have to be considerably earlier to offset what will be lost to the receiver from the h-p cylinder and still raise the pressure in the receiver enough to cause the 1-p cylinder to take its share of the load.

Duluth, Minn. E R WEBBER

Make The L-P Cylinder Do More Work

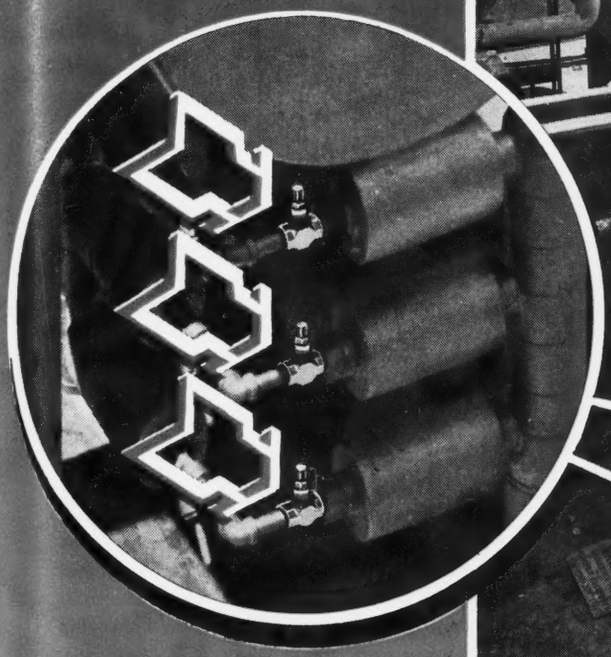
THE INDICATOR CARDS show a fault common with either tandem or cross-compound engines after operating a number of years, which is, that somehow the work seems to be taken over by the h-p cylinder.

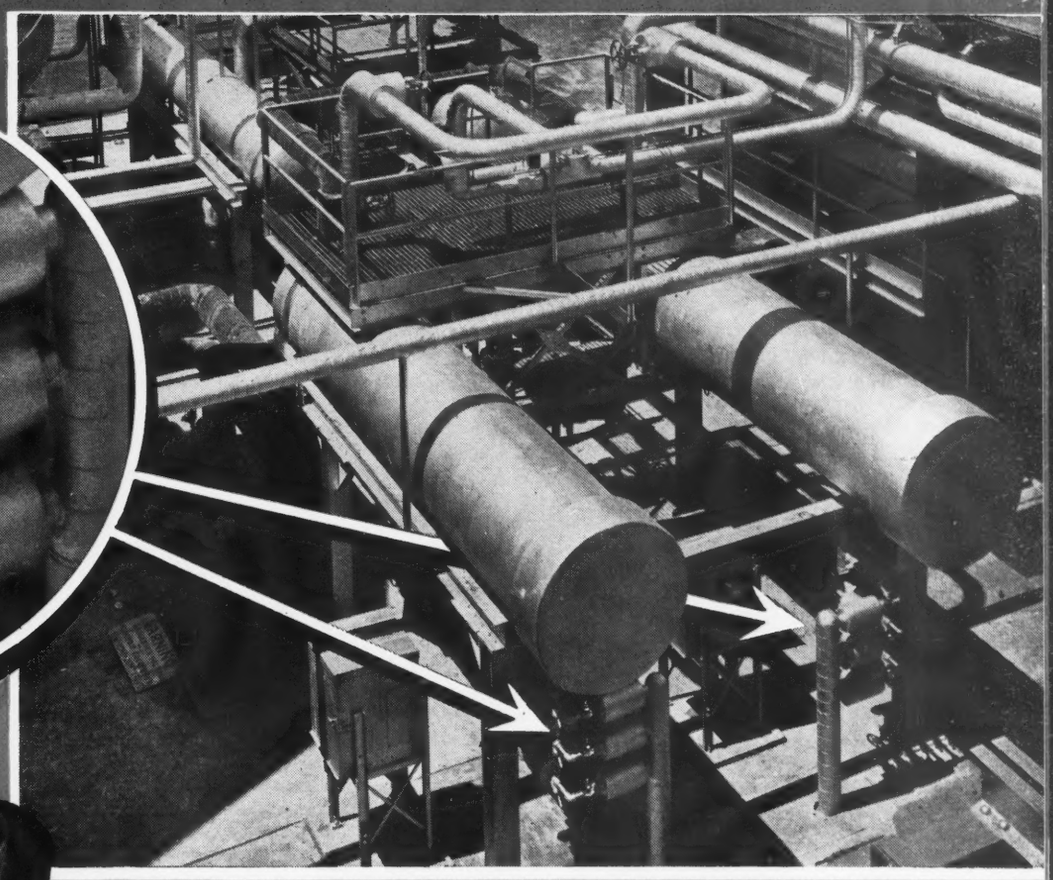
While the h-p cylinder card shows average good conditions, there is evidence of too much lead. Comparison of the two sets shows that the h-p cylinder carries most of the load.

On the other hand the 1-p card shows a number of defects. The first is the expansion curve, which shows bumps;

(*Continued on page* 126)

6 Little Traps Drain Big Heat Exchanger





THESE six little YARWAY IMPULSE TRAPS installed on two primary and two secondary heaters, keep these big heaters hot, free from condensate, to maintain pitch, from a nearby refinery, at 450° F — ready for the fuel burners of a large West Coast Utility.

The quicker heating and greater sustained heating efficiency which the Yarway Impulse Trap provides (continuous condensate discharge on heavy loads and intermittent discharge on light loads) make it the ideal trap for both refinery and oil field applications. (There are some refineries using as many as 2,000 Yarway Traps.) Then, too, it is suitable for all pressures without change of valve or seat. Its compactness simplifies installation. Its simple, trouble-free design (only one moving part) ensures dependability in hard service. Its first cost often is less than that of repairing other type traps.

More than 150,000 YARWAY IMPULSE TRAPS have been purchased for service on land and sea.

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YARWAY IMPULSE STEAM TRAP

this may be attributed to a defective indicator or a weak spring. The loops in the exhaust line are caused by over-expansion, possibly caused by too light a load or incorrect cutoff.

The severe hump on the exhaust line of the crank-end l-p card shows that the exhaust valve must be restricting the port at its extreme position, indicating too much lap.

To overcome this trouble, make the cutoff of the l-p cylinder steam valves earlier than the valves in the h-p cylinder, thereby raising the receiver pressure and making the l-p cylinder do more work.

Grand Rapids, Mich. J M GORRIE

Restricted Exhaust Port

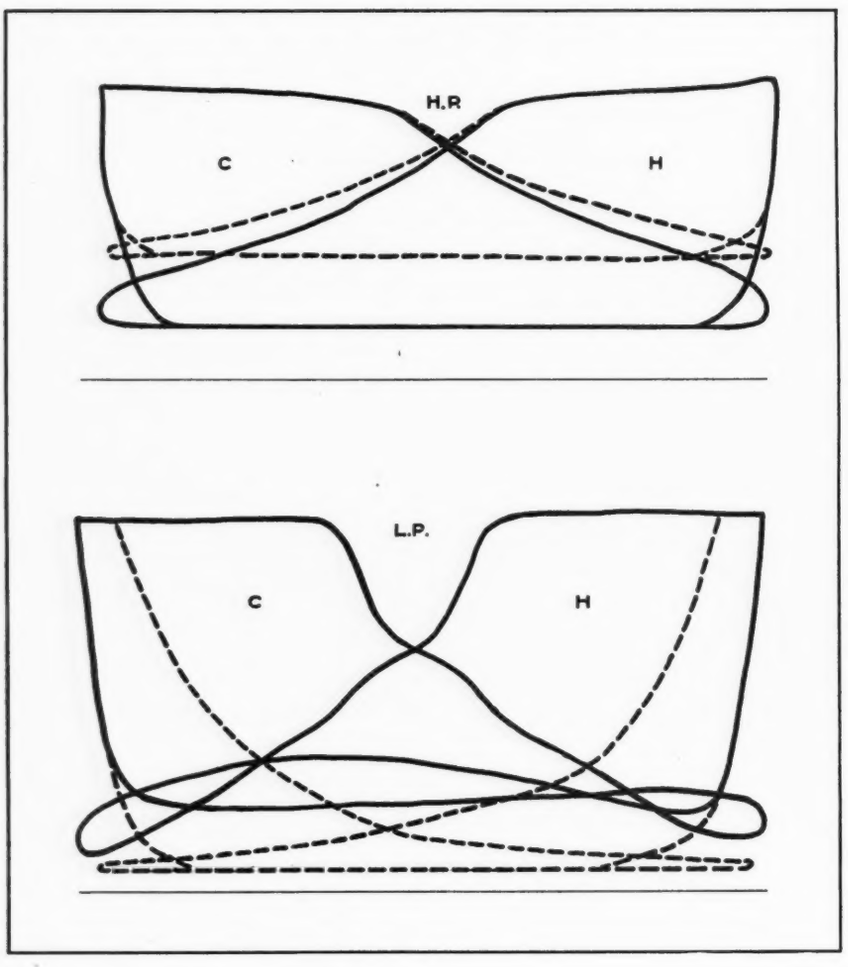
GIW'S CARDS WERE TAKEN at a load of 270 hp, which by measurement shows the following: mep in h-p cylinder = 66 psi and l-p cylinder = 6.3 psi, giving an ihp of 220 for the h-p and 81.8 for the l-p cylinder.

This condition is the cause of the poor card on the l-p cylinder. Receiver pressure of 25 psi is not sufficient to maintain the expansion curve above 4 psi to the end of the stroke; therefore, before the exhaust valve opens the pressure has dropped below that in the exhaust-system.

When the exhaust valve opens, the pressure flows back into the cylinder, thus forming the loops. The humps in the exhaust line are caused by this volume of steam being pushed back through a restricted exhaust port. This also causes the hump in the expansion line of the opposite card.

To divide the load evenly we require a mep of 40.3 psi on the h-p and 10.9 psi on the l-p piston. To achieve this we must shorten the cutoff in the l-p cylinder so that instead of cutting off at 1/3 stroke as at present we set the cutoff for about 1/16 of the stroke. This can be found by trial; it will result in a receiver pressure of 55 psi and should give cards as shown by the dotted lines drawn over the original cards. The l-p card should then be measured on a 30-lb spring and the h-p card on an 80-lb spring.

Kearny, N. J. GEORGE MCNALLY



Editors Note: Some difference of opinion has been expressed concerning the best remedy for the expansion loops. Changing the l-p cylinder cutoff will change the backpressure on the h-p piston thereby affecting its capacity for doing useful work. As the h-p cylinder appears to be doing most of the work, an earlier cutoff on the l-p cylinder would give it a higher initial pressure, and would increase the backpressure on the h-p cylinder. This should tend to equalize the load if the two cylinders are of the correct ratio.

How to Align Lineshafting

Answers to July Question 2

The Question

I WOULD LIKE TO HAVE *the opinions of* POWER *readers on the correct procedure for aligning lineshafting. Should the alignment be done with the belts on or off the pulleys? It appears to me that if the shafting is aligned with the belts off the pulleys the increased loading when they are in place will cause misalignment. I believe this should be checked under or as close to operating conditions as possible.*—CAA.

Lineshafts Must Be Level And Parallel

WHENEVER IT IS NECESSARY to align shafting of any kind it should be aligned with all belts off the pulleys. This will allow the shafting to be moved freely and a better job of aligning done. After the shafts are aligned, each belt should be cut to proper length so as to give the proper tension for each set of belts.

In aligning shafting there are four things to think of; shafts must be level, either on a horizontal or a vertical plane, and must be parallel to each other; the bearings and supports must be ample enough to support the weight of the shafts and belts without heating in any way or wearing to any extent; and all pulleys must be in line with each other.

Bismarck, N. D. LESLIE BRADLEY

Use Transit and Targets

THE CORRECT METHOD of aligning shafting is to leave all belts in running position, so that all operating stresses will show during lining up the shaft.

The writer has reduced friction load by 30 hp on 2000 ft of shafting by the

(Continued on page 128)

THE *Gilmer* NATIONAL POWER-RECOVERY PLAN

USE WHAT YOU LOSE

IT SPOTLIGHTS POWER WASTE

ELECTRICITY
STEAM
MECHANICAL TRANSMISSION
COMPRESSED AIR
WATER
REFRIGERATION
BOILER ROOM
PRIME MOVERS

Gilmer BELTS

INSTRUCTIONS FOR USE OF ESTIMATOR

Gilmer BELTS

1. The Gilmer National Power-Recovery Plan contains a series of Estimators, each relating to a certain phase of power service such as electricity, steam, hot and cold water, mechanical transmission, compressed air, refrigeration, generation, etc. This Estimator covers that phase of power service assigned to you for checking for power leaks.

2. Spot and check all the leaks in the service. You probably know them well and welcome this opportunity to get the corrections made in order to improve production. The specific practical suggestions below may be helpful.

3. List the location of all principal power losses on the Estimator together with your recommendation for betterment. Group the losses as "Urgent", "Important", or "Less Important".

4. State the approximate time required to correct the power losses, and whether the needed materials for making the corrections are available. If they are not available, state what must be done to obtain them. Give an indication of the cost of the job.

5. Having filled out the Estimator, sign it, and return immediately to the person in your company from whom you received it.

Bear in mind that the objective of the Gilmer National Power-Recovery Plan is to save power. Do your part to make America *powerful* by reporting on this Estimator every principal power leak which it is feasible to correct in your department.

TYPICAL WAYS TO SAVE ELECTRICITY IN THE PLANT

Individual experience will suggest many other points at which power leaks can be plugged and power saved.

Fit the motor to the job—Inventory your motors in all departments. Make sure (a) that most efficient motors drive machines that run longest hours; (b) that each motor is big enough for the job, but no bigger (over-size motors lower power factor); (c) that low-speed alternating-current, direct-drive motors are not used where high-speed AC units with speed reducers would improve efficiency and power factor; (d) that several loads are grouped on one motor where this will reduce power consumption and increase production. **Result: Saving of 15 percent in kwhr consumption and 20 percent in kva load.**

★

Meter electricity to hold down wasteful use—Install individual meters on machines where friction load is likely to "creep up", and on large motors driving machines where operator controls amount of power used. Meter electricity to each factory department and charge department head for his actual consumption; nothing discourages waste like a monthly bill! **Result: 5 to 20 percent saving in total kwhr consumption.**

★

Check feeders to cut losses—Examine entire electrical distribution system to equalize loads on feeders, if necessary by interconnecting load centers. Test insulation to find defects causing actual leaks that sometimes amount to 5 to 10 percent of electricity distributed. Spot and correct overloaded feeders, particularly in buried conduits where overheating can cause failure. Remember that heat is the limiting factor; shift cables from high-temperature areas; rig means of cooling where shifting is impossible. **Result: 3 to 5 percent saving in kwhr consumption; 5 to 15 percent increase in feeder capacity; prevention of sudden failures in the distribution system.**

★

Boost power factor—If power factor is below 85 percent look for motors that are too large for their loads, for drives where synchronous motors should replace induction units. If these changes fail to increase power factor sufficiently, install capacitors. **Result: A boost in the power factor from 70 to 90 percent increases peak capacity 30 percent.**

★

Schedule loads to cut peaks—If peak load is high in relation to average loads, examine necessity of every load that contributes to the peak. See if some production operations can be staggered and if non-essential loads (air-conditioning for example) can be cut off during peaks. **Result: Capacity is increased 100 kw for every 100 kw shifted from peak.**

★

Lighting—Inventory all lighting for unneeded high-wattage lamps. Replace filament lamps with fluorescents, if obtainable, to get same illumination with 75 percent less kwhr consumption. Make one man responsible in each department for turning off unneeded lights. **Result: 50 percent saving in lighting kilowatt-hours and peak kilowatts.**

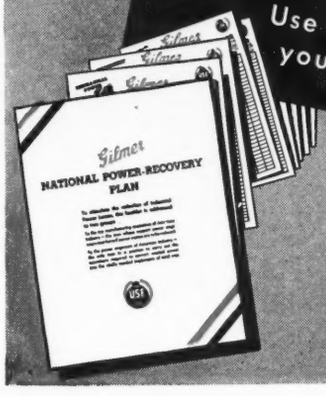
★

Maintain electrical system to cut losses and prevent failures—Organize for systematic cleaning, inspection, and repair of feeders, switchgear, transformers and motors. Establish a definite schedule and responsibility for these jobs, and see that the work is carried out. **Result: Savings of 10 to 15 percent by the proper care and lubrication of motors and mechanical power transmission equipment; breakdowns are prevented which cause vital production outages.**

★

The savings shown above are based on the experience of leading power engineers in hundreds of average plants throughout the country.

The Gilmer National Power-Recovery Plan is all contained in one convenient booklet. Use this coupon to get your copy.



L. H. GILMER COMPANY, Tacony, Phila., Pa.

Gentlemen:

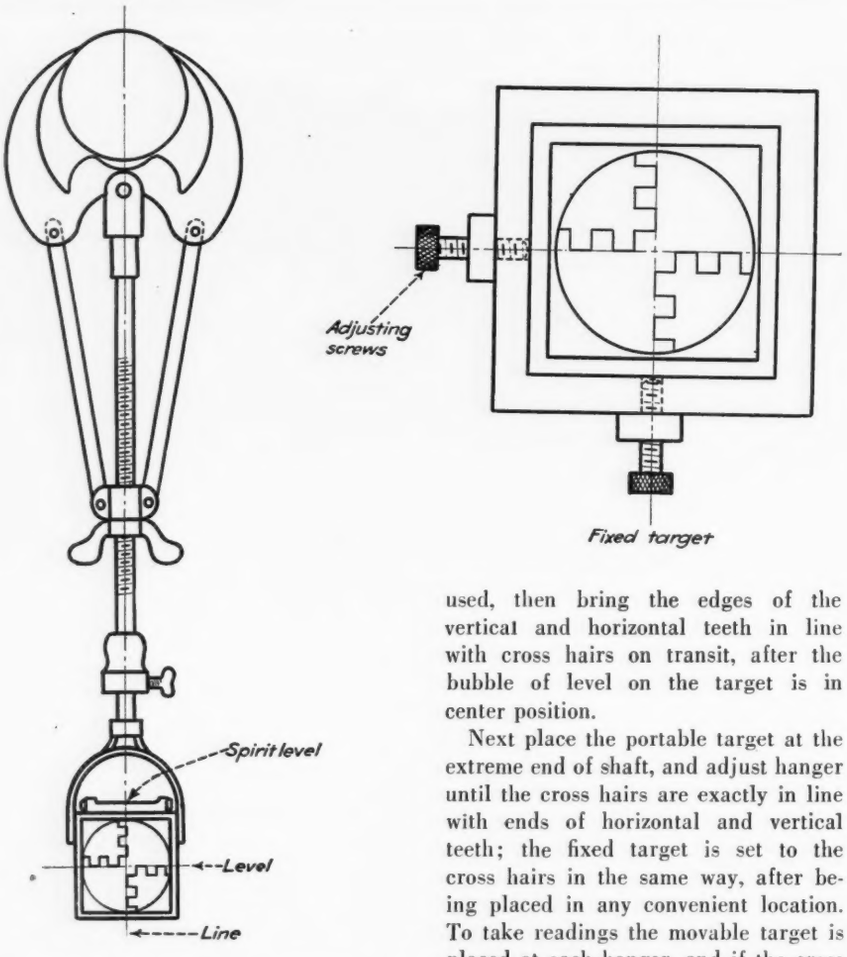
Please send me a copy of the National Power-Recovery Plan, without cost or obligation.

Name _____

Firm _____

Address _____

_____



use of Kinkead transit and targets, one target being portable, and adjustable to any size of shaft, the other being fixed to check the transit. These are shown in the sketch.

Set the portable target at the hanger or bearing where the transit is to be used, then bring the edges of the vertical and horizontal teeth in line with cross hairs on transit, after the bubble of level on the target is in center position.

Next place the portable target at the extreme end of shaft, and adjust hanger until the cross hairs are exactly in line with ends of horizontal and vertical teeth; the fixed target is set to the cross hairs in the same way, after being placed in any convenient location. To take readings the movable target is placed at each hanger, and if the cross hair does not exactly show on the horizontal teeth the shaft is out of level. If the cross hair does not come in line with the vertical teeth the shaft is out to the right or left accordingly.

Goderich, Canada G BARRETT

Belt Load, Tension Varies

THE PROPER WAY to align a shaft is with all belts removed or slacked off, and not under or as close as possible to operating conditions. One of the main disadvantages in aligning a shaft with the belts on is that belt tension changes, sometimes very rapidly. Another is that whenever the shaft is set in motion, tension ceases to be equal over and under the pulley and merges into the load on the pulling side of the belt.

Consider the sketch (right) in which the shaft presumably has been aligned with new belts leading in the same direction. As the belts stretch the shaft would need to be re-aligned again soon.

Even where belt tension does not change materially, aligning the shaft with the belts in place may really misalign it. For example, suppose three belts, *a*, *b*, and *c*, run from a lineshaft aligned with belts on, sketch, left. Suppose belt *b* has the greatest tension but the lightest load, while belt *a* has the lowest tension but the greatest load. On starting, the belt with the greatest tension and light load would probably maintain an almost balanced pull across the shaft. However, belts *a* and *c*, being heavily loaded, would slack off where they left the pulley, while the tension of the belts going on the pulley might be increased ten times. This would shift the shaft along the line of the resultant forces, and approximate the position of the dotted lines. No shaft can be aligned correctly with the belts on.

Menard, Ill. GEORGE HOLMAN

Use Plumb-Bob

CAA ANSWERS PART OF HIS QUESTION because all equipment should be checked for operating conditions after it has been set up.

A good method for lining up belt pulleys and shafting is to have the machines lined up, and properly leveled. Then with a datum line drawn on the floor parallel with the lineshaft, draw a perpendicular line from the point of a plumb-bob which has been dropped over the center of the pulley on the main lineshafting. Extend this perpendicular line toward the motor pulley. Find the center of the motor pulley and drop another plumb-bob toward the perpendicular line, drawn from the datum line. From the pulley center line, draw perpendicular lines through the center holes in the motor feet. Any misalignment may then be corrected by shifting the motor base and leveling it properly.

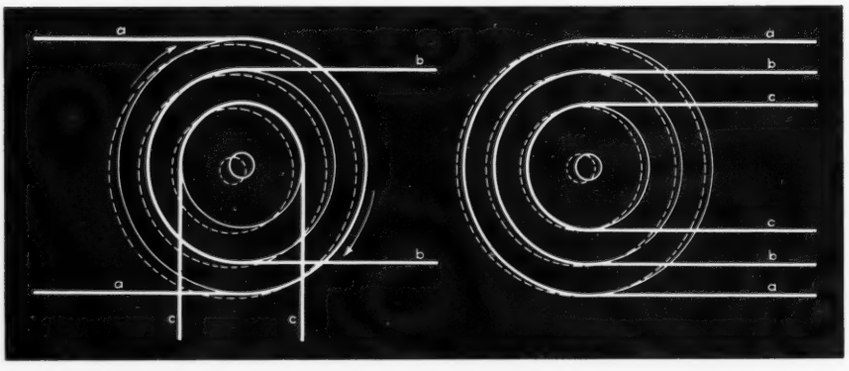
Fairview, N. J. M N GOZDENOVICH

Alignment Depends on Local Conditions

SHAFT ALIGNMENT is affected by factors such as the size and number of belts in use, belt tension, direction of belt pull and the spacing of hangers or supports.

When belts are small and few in number there is little likelihood of their

(*Continued on page* 144)



$H_2O+?$

WHEN Noah looked out of the ark after forty days and nights of rain all he could see was WATER that covered the earth—H_2O!

This water was practically pure H_2O, but in seeping thru the earth to form the present day sources of feed water supply, it accumulates various plus polutions which must be eliminated before using.

The Nalco engineers see every source of feed water supply as a challenge which calls for individual analysis and treatment to prevent damage and destruction to expensive plant equipment.

Let Nalco engineers make a survey of your water supply—they will recommend a treatment that will solve your problem.

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Nalco—*The Complete Water Treating Service*

About Air Compressors

Q—What kinds of valves are used on air compressors?

A—Air-compressor valves are divided into two distinct types, mechanical and automatic. The mechanical valve is operated by an external linkage connected to the rotating parts, whose position is fixed in relation to the piston position. Automatic valves depend for their operation on the difference in air pressure applied to the two sides of the valve.

Q—What is meant by the volumetric efficiency of an air compressor?

A. This is the ratio of the delivered capacity to the displacement of the compressor, expressed in percent. If the displacement and volumetric efficiency of the compressor are known, output can be determined quickly. The volumetric efficiency is of little importance as it refers only to capacity and is not a means of judging economical performance. Most compressors are now rated on actual delivery output in cu ft per minute.

Q—What is compression efficiency?

A—This is the ratio of the theoretical work required to compress the volume of air actually delivered, to the actual work done in the compressor cylinder as determined from an indicator diagram taken on the air cylinder.

Q—What is the mechanical efficiency of an air compressor?

A—This is the ratio of the indicated horsepower in the compressor cylinder to the indicated horsepower of the steam cylinder or to the brake horsepower output of the driving motor for electric drive. The difference between the two represents power used to overcome mechanical losses in the machine. These losses depend on design and care during operation.

Q—What precautions should be taken when installing air-compressor intake piping systems?

A—The intake should, whenever possible, be located outside the building in a cool area free from dust. The opening should be inverted to prevent entrance of rain and snow and should be located about 10 ft above the ground level. A screen should protect the opening. As dust is usually present to some degree, an air filter should be placed between air inlet and compressor. Intakes should never be located where there is any possibility of steam or excessive moisture being drawn in with the air.

Q—How is the overall efficiency of a compressor computed?

A—It is the product of the compression and mechanical efficiencies on a steam-driven compressor, and in the case of a power-driven unit, it is found by multiplying the compression efficiency by the mechanical efficiency and then by the overall efficiency of the prime mover.

Q—Can appreciable savings be made by using cool intake air?

A—The power required to compress air varies with the incoming temperature above or below 70 F. This is illustrated by comparing the values given in the table, which shows the quantity of air required to produce 1000 cu ft of free air at 70 F with varying inlet temperatures. The horsepower increases considerably for inlet temperatures above 70 F.

Effect of Intake Temperature on Capacity

Intake temp, F	Intake required, cu ft	Hp saved, %
30	925	7.5
40	943	5.7
50	962	3.8
60	981	1.9
70	1000	0.0
80	1019	—1.9
90	1038	—3.8
100	1057	—5.7
110	1076	—7.6
120	1095	—9.5

Courtesy Ingersoll Rand Co.

Q—How can I determine the size of pipe for an air-compressor intake?

A—The air intake for one compressor should have an area not less than 25% of the piston area, and in addition the pipe diameter should be increased 1 in. for every 10 ft of length. If more than one compressor is connected to the same intake, make the pipe area at least 25% of the total piston area and increase the diameter according to length, as above. For multi-stage compressors, consider the low-pressure piston only.

Q—Why should compressed air be passed through an aftercooler before entering the distribution system?

A—As air is compressed its temperature rises and its capacity for moisture doubles for every 20-F rise. Air compressed at 90 psi will usually have a temperature over 300 F. At this temperature its capacity for moisture is high and although the original quantity of moisture is present the relative humidity is quite low.

When this air enters the distribution piping its temperature soon falls to that of the surrounding air which rapidly reduces its moisture-carrying capacity. The excess moisture then appears as a fog and a portion is precipitated out as water which is carried along the pipeline.

Passing the air through an aftercooler reduces its temperature so that the moisture is precipitated where it can be removed before the air enters the system. Moisture in the air will wash lubricant from air-operated tools.

Q—Does the intercooler air pressure indicate trouble within the compressor?

A—The intercooler air pressure is a good indication of internal trouble in the cylinders. For every multi-stage compressor there is one correct intercooler pressure if the unit is operating properly. The correct intercooler pressure in psi absolute can be determined to an approximate value as follows:

$$PxRx1.09$$

P=intake pressure (absolute)

R=The l-p cylinder diameter squared divided by the h-p cylinder diameter squared.

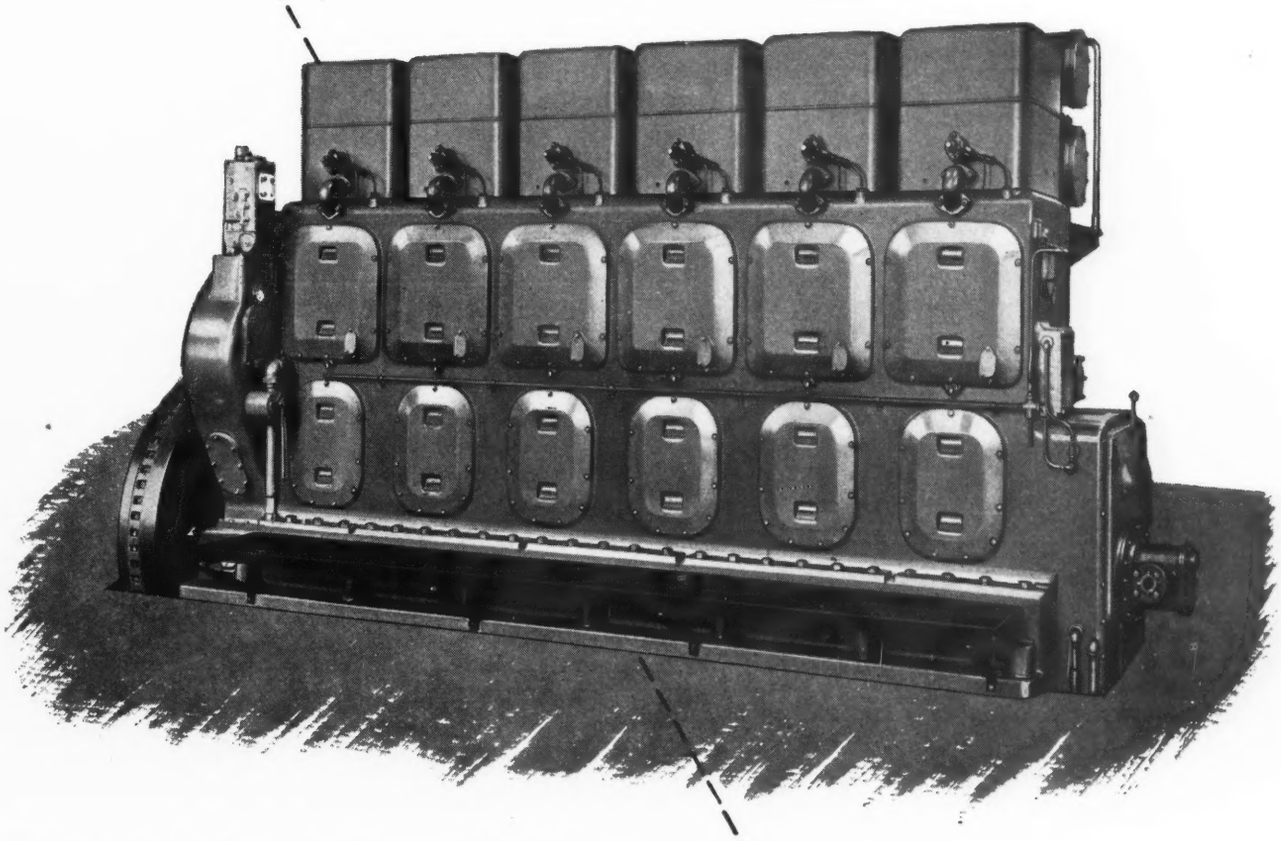
High intercooler pressure indicates leaking or broken valves in the h-p cylinder; low pressure indicates trouble in the l-p cylinder.

Q—How can the purchaser benefit by studying overall efficiencies?

A—Compressor performance comparison should be made on the basis of overall efficiencies because it is the ratio between the compressor output and the real power input, and shows what the actual cost of operation will be in terms of dollars and cents.

DEPENDABLE POWER

De La Vergne Diesel Engines



Today's production requirements demand uninterrupted power supply. World conditions make it imperative that every possible safeguard be taken to prevent power failure.

Your best insurance for an uninterrupted power supply is a De La Vergne Diesel Engine. Known throughout the country for their dependable and economical operation, De La Vergne Diesels are available in sizes from 200 bhp to 1,500 bhp. Let De La Vergne engineers investigate your power problem.

Baldwin De La Vergne Sales Corporation, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, California.

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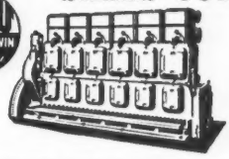

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

BUILDERS OF DEPENDABLE ENGINES SINCE 1880

POWER LINES

John J Cogan Retires as Macy's Top Engineer

John J Cogan, one of the country's outstanding power engineers, after nearly 30 years of service with R H Macy & Co, New York City, retired on August 1st from active management of the Maintenance Division of that company. He will continue as consultant in property management for the company and affiliated stores.

Mr Cogan was one of the ablest exponents of the isolated power plant in this country and has been able to prove his theories correct. When most of the large department stores in New York City were shutting down their power plants Mr. Cogan continued to enlarge and operate Macy's at a huge saving against what comparable services would cost if purchased.

When Mr Cogan came with Macy's in 1912 as assistant chief engineer the store was a 10-story building, having 1,100,000 sq ft of floor area, covering a little more than one-half block at the corner of Broadway and 34th Street. At that time the power-generating equipment consisted of eleven coal-fired boilers and 2000 kw of steam-engine-driven direct-current generators. Steam generated equalled about 100,000,000 lb and power 3,000,000 kwhr per year. Today the store covers a whole block and has 2,041,355 sq ft of floor area, making it the world's largest retail establishment. Power generating capacity has increased to 6450 kw and in addition 1710 hp of steam turbines drive compressors on the air-conditioning system. This power-plant equipment includes steam engines, low-pressure turbines, medium-pressure turbines, a mixed-pressure turbine, two slow-speed diesel engines and a high-speed diesel-driven unit. Last year the plant produced 560,000,000 lb of steam and generated 23,000,000 kwhr.

From 1926 when Mr Cogan took over complete charge as assistant general manager of planning and supervising all plant, department and building alterations and expansion, an almost constant series of progressive projects resulted in modernizing the original building and adding new buildings which brought Macy's to its present size.

Mr Cogan has worked under three presidents of Macy's and four general managers. He considers his position the most interesting and rewarding in the store despite the fact that "when you make a mistake you can't get rid of it simply by marking down the price." Greatly beloved and respected by his own staff, which numbers almost 700. Mr Cogan is known throughout the country and highly regarded as an outstanding engineer and an authority on mechanical and physical layouts for department stores and their operation. Frank J McKenna, formerly Mr Cogan's assistant, has been appointed to succeed him.

(Right) John J Cogan, executive engineer, R H Macy Co, shortly before his retirement, conferring with his successor, Frank J McKenna. Apparently he has found a spot in the power setup where operating efficiency can be still further improved

New Maintenance Ratings

The War Production Board has assigned an A-2 rating to deliveries of repair, operation and maintenance material for utilities production and pumping plant facilities, and an A-5 rating for all other utilities facilities, for similar purposes.

Preference Ratings of A-1-c and A-3 have been assigned to chemical producers for repair, operation and maintenance. The same amendment permits inventories of coal and coke to be built up to encourage accumulation of fuel stocks ahead of heavier demands on transportation facilities, expected next winter.

Must Cancel Duplicating Orders

The provision of Priorities Regulation No. 11 which requires companies operating under the Production Requirements Plan to cancel duplicating orders as soon as they receive their third quarter PRP certificate was emphasized recently in a statement by J S Knowlson, Director of Industry Operations.

"In order to clarify the picture of materials requirements in the war industries," Mr Knowlson said, "it is essential that no company should have orders outstanding for greater quantities of materials than it actually requires, or will be permitted to receive.

"Because of the shortage of materials many companies have placed duplicate orders with two or more suppliers, with the intention of cancelling the rest when one is filled. This practice gives a distorted picture of materials requirements and is therefore forbidden, for all companies operating under the Production Requirements Plan. If such a company has orders outstanding calling for delivery in the third quarter of more material than it may receive under the terms of its PRP certificate, the duplicating orders must be canceled immediately upon receipt of the third quarter certificate."

Regulation No. 11 provides that "No PRP unit shall duplicate, in whole or in part, purchase orders which it has placed with one or more suppliers for

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TIME··· MONEY··· METAL!

Who can calculate, these days, the worth of every minute, every penny, every scrap of metal saved? And plants with pipelines of Anaconda Copper Tubes are saving every one of these precious elements day in and day out like this:

1. Copper Tubes end forever shutdown losses caused by repairs and replacements due to rust . . . they can be swiftly and easily installed . . . they're readily adaptable for variation in plant layout.

2. Smooth interiors provide increased flow, thus reducing pumping costs.

3. Their rust immunity and corrosion resistance preserve the metal . . . solder type fittings permit thinner wall thicknesses, hence less metal, lighter weight, less space.

Mark well these advantages of Anaconda Copper Tubes in your plans for the future. What they are doing today in the fight for victory, they will do for you in peace. 4246A

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THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

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delivery of any material (whether rated, unrated or allocated) in such manner that the amount of such material ordered exceeds the amount actually required for delivery, even though the PRP Unit intends to cancel or reduce its purchase orders prior to completion of delivery, to the amount of actual requirements as rated or otherwise authorized on its PRP certificate. Each PRP unit immediately upon receipt of its PRP certificate shall cancel or reduce its outstanding purchase orders calling for delivery within the quarter covered by such certificate to the amount of its actual requirements as rated or otherwise authorized on such certificate, or any previous PRP certificate and not yet received."

The regulation also requires placing of purchase orders with spacing of delivery dates, so far as practicable, to spread deliveries equally over the three months covered by the PRP certificate, and specifically forbids receipt of more than 40 percent of permitted deliveries of any material in the first month of the quarter, or more than 80 percent in the first two months, except in unusual situations.

A continuous audit of the books of companies operating under the Production Requirements Plan has been instituted by the Compliance Branch of the Bureau of Priorities, with the aid of the Field Investigation Service, and the Wage and Hour Division of the Department of Labor.

Form Cable Advisory Committee

A copper, wire and cable industry advisory committee has been named to work with the War Production Board. Francis R Kenney, research advisor of the copper branch of WPB, is the governmental presiding officer of the committee which consists of: W E Sprackling, Anaconda Wire & Cable Co; D R G Palmer, General Cable Corp; H L Erlicher, General Electric Co; Wiley Brown, Phelps-Dodge Copper Products Corp; C A Scott, Rome Cable Corp; F C Jones, Okonite Co; and Everett Morss, Simplex Wire & Cable Co.

ASHVE Committee Surveys Fuel Situation

Recently, the War Service Committee of the American Society of Heating and Ventilating Engineers delivered its findings and recommendations to Secretary of the Interior Harold L Ickes, Coal and Petroleum Coordinator.

In response to the offer of the Society to make its research and other facilities available to the government, Secretary Ickes requested the Society's cooperation in finding a solution for the current fuel supply problem which faces the eastern states and the Pacific northwest during the coming winter.

The members of the War Service Committee who presented the report, Chairman B M Woods, Professor of Mechanical Engineering, University of California; and W L Fleischer, Consulting Engineer, New York; made it plain that current surveys must accurately determine the amount of fuel (coal and oil) that is expected to be available in the critical area. They offered four specific methods which could be progressively applied to meet even the most drastic fuel conservation program and suggested specific methods to inform the public properly concerning economic and speedy methods of adapting or installing accessory equipment to meet the existing emergency.

No Profit in Hoarding

An effort to end the widespread practice of holding scrap metals to await rumored increases in ceiling prices was made in August by Price Administrator Henderson. In a letter to WPB's salvage chief, Lessing Rosenwald, Henderson promised that present scrap prices will not be raised.

"There will be no profit in hoarding," Henderson wrote, "only a loss of self-respect by anyone gambling for personal gain at the expense of the common effort to whip our enemies."

Henderson's letter was followed by an appeal from Rosenwald for a nation-wide "spring housecleaning" for materials which can be salvaged. There's a big chance for local promotion, through salvage committees now in existence in 46 states, in such a drive.

Broadcasts Feature "The Engineer at War"

Thursday, July 16, marked the beginning of a series of 11 nationwide broadcasts (NBC—6:30 to 6:45 pm) dealing with the contributions of engineers to the prosecution of the war. Sponsored by a committee representing the national engineering societies and with the cooperation of Dr James Rowland Angell, NBC Public Service Counsellor, these programs discuss blackouts, protection against bombs and gas, tanks, ships and planes, petroleum production, power, and communications. The material has been prepared by men selected because of special knowledge and will include controversial subjects. Changes will be made when requested by OCD up to the minute that a program goes on the air, so that latest and most authoritative data will be given.

W E Corrigan Advanced

W E Corrigan, vice-president of American Locomotive Co in charge of munitions and miscellaneous sales, has assumed additional duties as head of

(*Continued on page* 180)

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You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

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...an Essential Part of the Scientific Approach to Piping Problems

Power Piping prefabrication of subassemblies, heat treated and stress relieved under rigid engineering control, means exact adherence to specifications, negligible field welding and simplification of erection.

Use of Power Piping Division facilities for prefabrication of piping systems of any character helps to overcome the problem of equipment shortage and enables delivery and erection to be made within reasonable limits.

A consultation with Power Piping engineers will often result in practical recommendations for the substitution of materials to relieve bottlenecks due to material shortages.

One of a large number of subassemblies prefabricated in shops of Power Piping Division. Forged and bored carbon steel piping, 10" ID 17½" OD. Flanges 17⅛"x31½"x8¾". For 14,000 ton Hydraulic Forging Press. Photograph taken during preparations for testing.

Power Piping Functional Hangers and Vibration Eliminators facilitate erection as well as measure and control the behavior of any piping system.

The correlated use of FLEXANAL CHARTS AND HANGER BULLETIN No. 1863 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained by requesting them on your business letterhead.

BLAW-KNOX COMPANY

POWER PIPING DIVISION

1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

What Happens when a Plant Slows Down?

In modern warfare, as never before, the fate of the fighting man at the front depends on the man at home.

For total warfare requires vast quantities of arms and equipment, and the resources of a whole nation to make them. And unless we make them—"enough, in time"—and deliver them to our forces, we are sacrificing lives as surely as if we sent soldiers to battle with hands tied.

That is why it is vital today to avoid anything, however small, that might slow up production. That is why the prevention of interruptions caused by valve failures assumes new importance.

Because of this, and because many valves in present use are practically irreplaceable until after the war, wise management will revise and improve its standards of valve maintenance.

Regular inspection of valves by competent men . . . replacement of worn parts before destructive deterioration takes place . . . proper installation of new valves . . . careful instruction of new workers . . . all will reduce slow-downs due to valve failures, and help to assure "enough, in time."

You are invited to consult with Jenkins Engineers on any phase of the problem of valve conservation.

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JENKINS VALVES

For every industrial, engineering, marine and power plant service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

A Picture of Valve Destruction

. . . because *INSTRUCTION was Inadequate*

MUTILATED by MAN-HANDLING

A Jenkins Bronze Valve Bonnet, rendered useless by carelessness of improperly trained men.

THIS valve never had a chance! The neck of the bonnet is crushed, and the threads within distorted, rendering the spindle inoperative. Some heavy-handed workman applied a pipe wrench to the neck when trying to loosen the packing nut, which had been improperly turned down (with a wrench) so tight that it jammed.

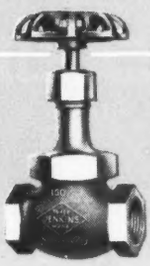
Had the packing nut been turned down properly *(finger-tight only)*, it could have been removed easily with a hexagon wrench without touching the neck of the bonnet. The damage could have been avoided, and the bonnet preserved for many more years of service. No wrench of *any* kind should ever be used on the bonnet neck!

Since bronze is one of the scarcest of the critical metals, and bronze valve parts almost unobtainable, careless destruction of this kind must be prevented.

Install valves properly...inspect them regularly . . . replace worn parts before deterioration occurs . . . instruct new workmen thoroughly. This four-point program will reduce slow-downs due to valve failure, and help keep vital war production ahead of schedule.

Jenkins Engineers will give you any help you need in organizing your program of valve conservation.

JENKINS BROS., 80 White St., New York, N. Y.; Bridgeport, Boston, Atlanta, Philadelphia, Chicago, Houston. Jenkins Bros., Limited, Montreal, London.



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For every industrial, engineering, marine and power plant service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

Faster Selection of Correct Steam-Pipe Thickness

I — Schedules 10, 20, 30, 40

Maximum working pressures for seamless carbon-steel pipe, ASTM A-106-41, Grade B, silicon killed

Working temperature, F				150	250	350	400	450	500	550	600	650	700	750	800
Allowable working stress, *S*, psi				15,000	14,400	13,800	13,400	13,200	12,900	12,600	12,300	12,000	11,400	10,400	9,100
Pipe size, inches	Pipe OD, inches	Nominal thickness, inches	Minimum thickness, inches												
Schedule 10															
14	14.0	0.250	0.219	330	320	310	300	....	290	....	270	270	250	....	200
16	16.0	0.250	0.219	290	280	270	260	....	250	....	240	230	220	....	180
18	18.0	0.250	0.219	260	250	240	230	....	220	....	210	210	200	....	160
20	20.0	0.250	0.219	240	230	220	210	....	200	....	190	190	180	....	140
24	24.0	0.250	0.219	200	190	180	180	....	170	....	160	160	150	....	120
30	30.0	0.312	0.273	210	200	200	190	....	180	....	170	170	160	....	130
Schedule 20															
8	8.625	0.250	0.219	540	520	500	480	....	460	....	450	430	410	....	330
10	10.75	0.250	0.219	430	420	400	390	....	370	....	360	350	330	....	260
12	12.75	0.250	0.219	370	350	340	330	....	320	....	300	290	280	....	220
14	14.0	0.312	0.273	450	430	410	400	....	390	....	370	360	340	....	270
16	16.0	0.312	0.273	390	380	360	350	....	340	....	320	310	300	....	240
18	18.0	0.312	0.273	350	340	320	310	....	300	....	290	280	270	....	210
20	20.0	0.375	0.328	400	380	370	360	....	340	....	330	320	300	....	240
24	24.0	0.375	0.328	330	320	310	300	....	290	....	270	270	250	....	200
30	30.0	0.500	0.437	380	360	350	340	....	320	....	310	300	290	....	230
Schedule 30															
8	8.625	0.277	0.242	620	590	570	550	....	530	....	510	500	470	....	380
10	10.75	0.307	0.269	670	550	530	510	....	490	....	470	460	440	....	350
12	12.75	0.330	0.289	530	510	490	480	....	460	....	440	430	410	....	330
14	14.0	0.375	0.328	570	540	520	510	....	490	....	470	460	430	....	350
16	16.0	0.375	0.328	500	480	460	440	....	430	....	410	400	380	....	300
18	18.0	0.437	0.382	530	510	490	480	....	460	....	440	430	410	....	320
20	20.0	0.500	0.437	560	540	520	500	....	480	....	460	450	430	....	340
24	24.0	0.562	0.492	540	520	500	480	....	460	....	440	430	410	....	330
30	30.0	0.625	0.547	490	470	450	430	....	420	....	400	390	370	....	300

Schedule 40																			
Temperature, F															850	900	950	1,000	
Stress, *S*															7,400	5,600	3,800	2,000	
½	0.840	0.109	0.095	1610	1550	1480	1440	1420	1390	1350	1320	1280	1220	1120	980	800	600	410	220
¾	1.050	0.113	0.099	1400	1350	1290	1250	1240	1210	1180	1150	1120	1070	960	860	690	530	360	190
1	1.315	0.133	0.116	1510	1450	1390	1350	1330	1300	1270	1240	1210	1150	1050	920	750	570	390	210
1¼	1.660	0.140	0.122	1030	990	950	920	910	890	870	850	830	790	720	630	510	390	270	140
1½	1.900	0.145	0.127	980	940	910	880	870	850	830	810	790	750	680	600	490	370	250	130
2	2.375	0.154	0.135	890	850	820	790	780	760	750	730	710	680	620	540	440	330	230	120
2½	2.875	0.203	0.178	1180	1140	1090	1060	1040	1020	990	970	950	900	820	720	590	440	300	160
3	3.5	0.216	0.189	1070	1020	980	950	940	920	900	880	850	810	740	650	530	400	270	150
3½	4.0	0.226	0.198	1000	960	920	900	880	860	840	820	800	760	700	610	500	380	260	140
4	4.5	0.237	0.207	950	910	880	850	840	820	800	780	760	720	660	580	470	360	240	130
5	5.563	0.258	0.226	870	840	800	780	770	750	730	720	700	660	610	530	430	330	220	120
6	6.625	0.280	0.245	820	790	750	730	720	710	690	670	660	620	570	500	410	310	210	110
8	8.625	0.322	0.282	760	730	700	680	670	660	640	620	610	580	530	460	380	290	200	110
10	10.75	0.365	0.319	710	680	660	640	630	610	600	590	570	540	500	430	350	270	180	100
12	12.75	0.406	0.355	690	660	630	610	600	590	580	560	550	520	480	420	340	260	180	100
14	14.0	0.437	0.382	680	660	630	610	600	590	580	560	550	520	480	420	340	260	180	100
16	16.0	0.500	0.437	700	670	650	630	620	600	590	580	560	530	490	430	350	260	180	100
18	18.0	0.562	0.492	720	690	660	640	630	620	600	590	570	540	500	430	350	270	180	100
20	20.0	0.593	0.519	690	660	630	610	600	590	580	560	550	520	480	420	340	260	180	100
24	24.0	0.687	0.601	670	650	620	600	590	580	570	550	540	510	470	410	340	250	170	90

▶ Tabulated values are gage pressures in pounds per square inch at which the stated weight of pipe can safely operate for each nominal size. For example, a ten-inch Schedule 30 pipe operating at 700 F can carry any working pressure up to 440 psi gage.

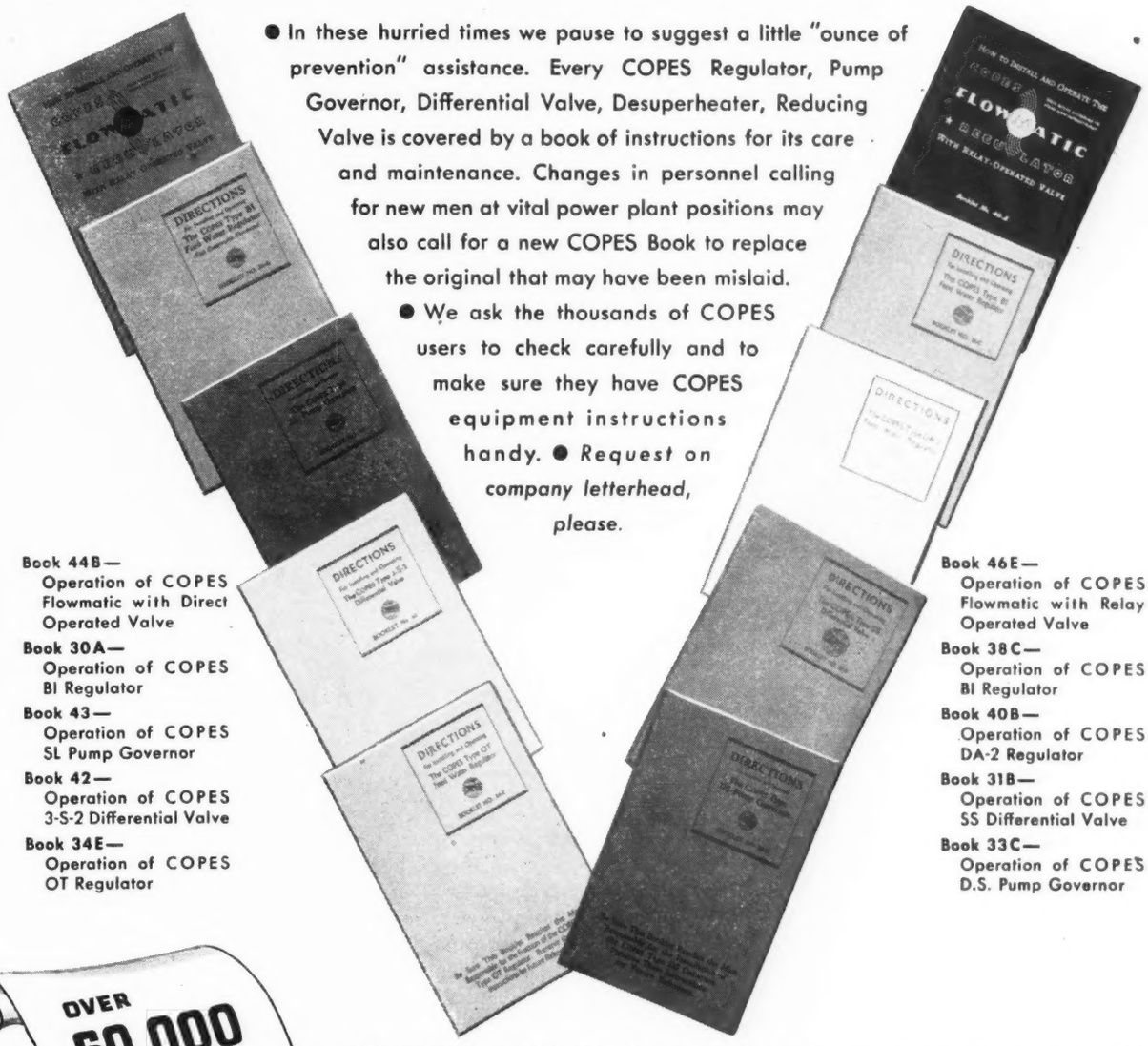
Calculations are based on American Standards Association Code for Pressure Piping, 1942. The specified allowance for corrosion is included, that is, 0.050 in. on wall thickness for pipe sizes 1-in. and smaller, and 0.065 in. for all larger sizes, but no separate allowance has been made for threads. Minimum wall thickness in Column 4 is nominal wall thickness of Column 3 less 12½%.

These values apply only to seamless Grade B pipe of the ASTM designation A-106-41 for silicon-killed steel. For other materials different values of allowable stress are specified in Par. 122 of the Code for Pressure Piping.

These values are the same as permitted by Power Boiler Code for temperatures over 650 F. For lower temperatures, values listed for 650 F must be used.

© POWER

BE SURE YOU HAVE YOUR COPES EQUIPMENT DIRECTIONS HANDY



● In these hurried times we pause to suggest a little "ounce of prevention" assistance. Every COPES Regulator, Pump Governor, Differential Valve, Desuperheater, Reducing Valve is covered by a book of instructions for its care and maintenance. Changes in personnel calling for new men at vital power plant positions may also call for a new COPES Book to replace the original that may have been mislaid.

● We ask the thousands of COPES users to check carefully and to make sure they have COPES equipment instructions handy. ● *Request on company letterhead, please.*

Book 44B—
Operation of COPES Flowmatic with Direct Operated Valve

Book 30A—
Operation of COPES BI Regulator

Book 43—
Operation of COPES SL Pump Governor

Book 42—
Operation of COPES 3-S-2 Differential Valve

Book 34E—
Operation of COPES OT Regulator

Book 46E—
Operation of COPES Flowmatic with Relay Operated Valve

Book 38C—
Operation of COPES BI Regulator

Book 40B—
Operation of COPES DA-2 Regulator

Book 31B—
Operation of COPES SS Differential Valve

Book 33C—
Operation of COPES D.S. Pump Governor

OVER **60,000** COPES FEED WATER REGULATORS IN SERVICE

NORTHERN EQUIPMENT COMPANY • *921 Grove Drive, Erie, Pa.*

Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls
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BRANCH PLANTS IN CANADA, ENGLAND • REPRESENTATIVES EVERYWHERE

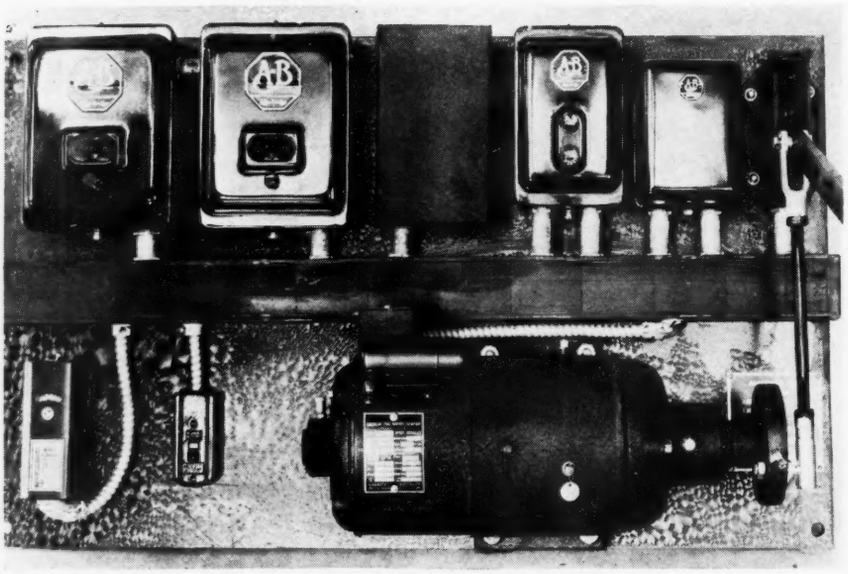
★ **GET CLOSER LEVEL CONTROL WITH THE**

COPES FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

FLOWMATIC

★ **REGULATOR**

WHAT'S NEW IN PLANT EQUIPMENT

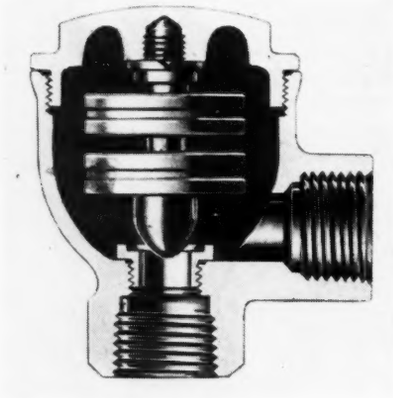


Automatic Damper Regulator

AMERICAN DAMPER REGULATOR is adapted to Fyr-Feeder installations operated by on-and-off control method. Regulator is mounted on standard Fyr-Feeder control panel as shown. Consists of a powerful gear-motor which moves damper control arm up and down. Limit switches stop motor at proper points at top and bottom of the stroke. In operation, when pressure switch on the control panel closes, because of a drop in steam pressure below the predetermined point, damper regulator motor starts, opening stack damper. Ten seconds later, after damper is fully opened, switches on control panel start coal feed, coal blower, and forced-draft-fan motors. When steam pressure reaches desired point, pressure switch opens, stopping coal feed, coal blower, and forced-draft-fan motors, and starting damper regulator motor. This runs for ten seconds, closing stack damper and conserving full furnace heat. *American Coal Burner Co, Chicago, Ill.*

Cast-Iron Traps

TYPE 17-D of new Hoffman "V . . ." series of cast-iron traps, illustrated, has a nominal capacity of 200 sq ft of direct radiation. Body and cap are made of cast gray iron with left-hand-thread inlet connection. Thermostat is composed of a special non-corrosive alloy which will not soften under temperatures far above those encountered in service, nor crack when subjected to repeated action. The whole thermostat and pin assembly may be interchanged in all 17-D bodies. An important feature of these traps is found in the renewable valve seat. If long use or unusual circumstances cause wear at this point, a simple replacement restores entire trap to useful service. *Hoffman Specialty Co, 1001 York St, Indianapolis, Indiana*



Anti-Freeze

"NO-FREEZE" is permanent-type anti-freeze, which, according to manufacturer, contains no critical materials and is therefore available in unlimited quantities. Manufacturer guarantees product against freezing down to 35 F below zero; to prevent rust of any part of the cooling system; not to boil off or evaporate (boiling point 324 F) and never to require testing for anti-freeze strength. *Great Northern Chemical Co, Oak Park, Ill.*

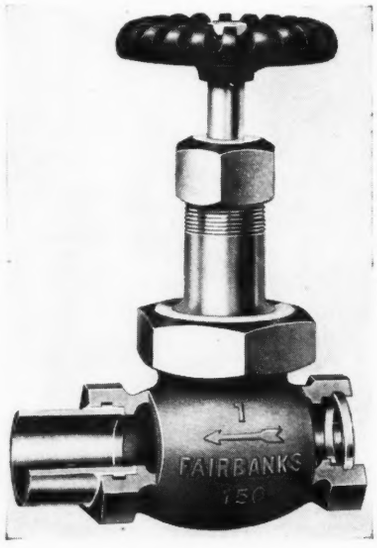
Sabotage Protection

TO TAKE THE PLACE OF COSTLY, short-lived sandbag barricades for sabotage protection around power transformers, substations and other vulnerable public utility and industrial equipment, company has devised economical wall of lightweight concrete blocks filled with sand. Blocks are made with Celocrete lightweight aggregate, an expanded blast-furnace slag. Tests have demonstrated that a wall of 12-in hollow blocks filled with sand will stop high-powered 30-caliber rifle and machine-gun fire at distances as short as 10 ft. The concrete-block wall, according to the maker, has several advantages over the sandbag barricade. The block wall costs from one-half to two-thirds less, and its life is many times longer. *The Celotex Corp, 919 N Michigan Ave., Chicago, Ill.*

Faircoseal Bronze Valves

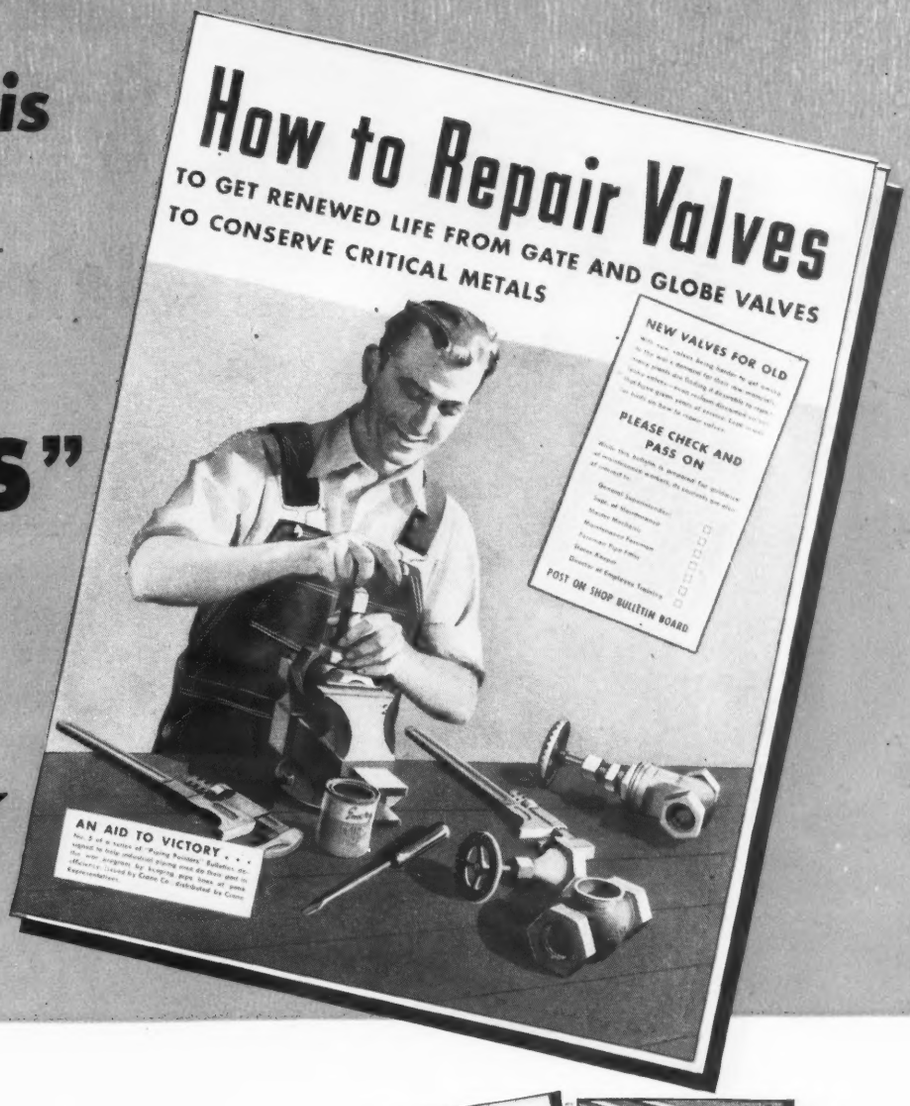
FAIRCOSEAL BRONZE VALVES contain pre-inserted rings of Sil-Fos silver brazing alloy in the port openings, instead of threads. With this design, valve and pipe can be easily brazed together forming a Silbraz joint, designed to withstand tension, compression, torsion, vibration and corrosion to the same degree as the pipe or tube. With these bronze valves, copper, yellow or red

(*Continued on page* 148)



You'll want this latest "PIPING POINTERS" BULLETIN

Here's why


How to Repair Valves
TO GET RENEWED LIFE FROM GATE AND GLOBE VALVES
TO CONSERVE CRITICAL METALS
NEW VALVES FOR OLD
PLEASE CHECK AND PASS ON
POST ON SHOP BULLETIN BOARD
AN AID TO VICTORY

1 It's timely and is written to help you keep pipe lines flowing. And it's authoritative, for it's based on the vast experience of America's leading producer of valves—Crane.

2 Bulletin No. 5 deals specifically with proper repair and reclamation of valves; tells how to keep them working better and longer. That's mighty important—now when piping equipment is harder to get—and critical metals must be conserved for war.

3 "Piping Pointers" are ideal for training and supervising the new men required to keep plant equipment in shape under triple-shift operation. Also, they help keep veteran workers "brushed-up" on modern piping practices.

These Bulletins are available *free* to any plant—for its piping men, maintenance shops, and employee training schools. They're one of the ways Crane is sharing its basic information as the Nation's leading valve manufacturer with plants who are building for Victory. Ask your Representative for copies—or write direct.

HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!
TIPS ON VALVE TRIM
TO HELP KEEP PIPING ON THE JOB
HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE

BACK ISSUES ARE AVAILABLE. *To meet the demand for "Piping Pointers" from plants in every industry, extra supplies of back issues are available. Be sure to get the entire series* NOW—*when you need them most.*

CRANE

CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVENUE, CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

Use for Methuselah . . .

We could use Methuselah, if he were alive today. According to the Old Testament, he lived 969 years. That would mean that a modern Methuselah would have begun his life in about 1000 A.D., early enough to have seen the whole development of our modern living. He'd have been through—and watched the discarding of—countless theories and experiments. He'd have experienced all kinds of business cycles, from that long depression known as the Dark Ages to our recent ones.

But, more than all that, think of the experience, the judgment, the wisdom, that he couldn't have helped but acquire in all those years!

Methuselah is long dead, but what about the older men whom we do have alive today? We aren't using them yet, nowhere near as much as we can and must. True, most of them have not the alertness, the capacity for work, or the flexibility in training of younger men. If they had, they'd be in the Army too. But they do have a long background of skill, experience and judgment that is built only through years of living.

Among them are men of many professions, many backgrounds. Among them are men you can certainly use—men who can compensate for the younger men called to service, who can provide a background of knowledge that will make up for the loss of the younger man's aggressiveness. Perhaps they cannot stand the physical strain imposed upon younger men. but is that necessary? Their experience will undoubtedly suggest ways to do things that will not require physical strain—or if it does they can be the directing power behind unskilled muscles. Again, any man over 60 worked during the years when all our modern machinery was not available, so he undoubtedly learned to do things by hand that the modern workman can do only by machine. Today, when machines are not available, that experience is priceless.

So . . . inquire among your friends, check back on old employment records, dig through local records of every sort. You'll uncover men whose fingers itch for the feel of a valve wheel, whose shoulders would feel at home again in a coverall or in the crossed straps of overalls. You'll give them back a piece of their youth—and a chance to serve the country that has let them live their three-score years, with each year better than the last.

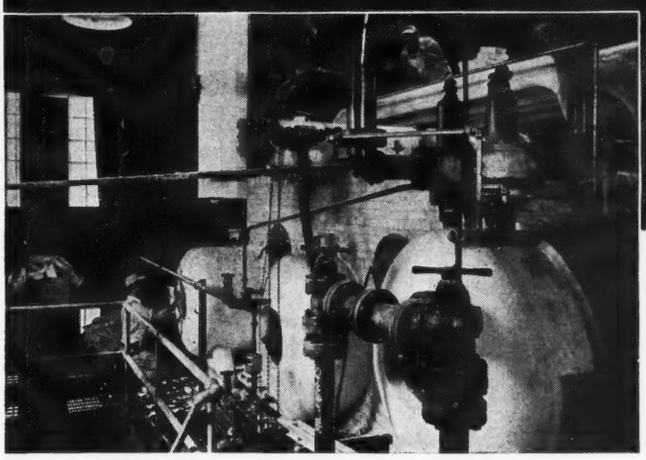
George Edwards

Engineer

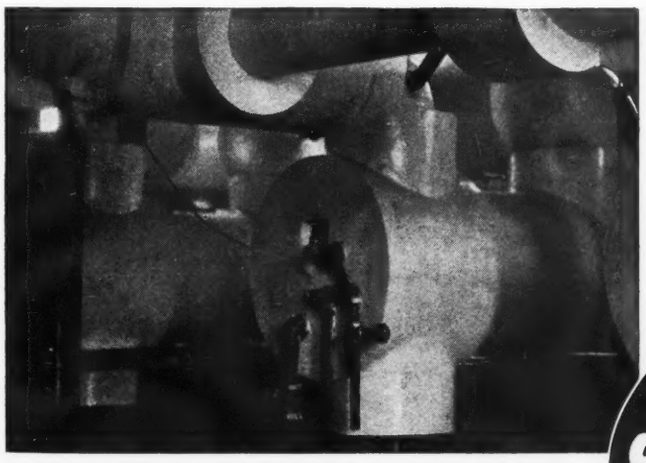
STEAM PIPE INSULATION

J-M 85% Magnesia

The Most Widely Used Specification in Power Plant Insulation for More Than 50 Years



FOR PIPE COVERING . . . J-M 85% Magnesia Pipe Insulation is furnished in 3-ft. sections or segments in the following thicknesses: Standard, 1½", 2", 2½", Double Standard and 3" (Double Layer). Often used as a second layer, outside of J-M Superex, where pipe temperatures are above 600° F.



IN BLOCK FORM . . . J-M 85% Magnesia Blocks are furnished 3"x18", 6"x36", 12"x36", in thicknesses of 1" to 4". Weight, about 1.4 lb. per sq. ft., per 1" thick.

. . . and for good reasons

At service temperatures up to 600° F., no insulation delivers more thoroughly satisfactory performance than J-M 85% Magnesia. That's a fact that's been proved time and again in power plants of every type. Light in weight, readily cut and fitted, J-M 85% Magnesia is easy to install. On the job, it provides ample mechanical strength, long life and high insulating efficiency. Engineers agree that, wherever used, J-M 85% Magnesia assures permanently economical service.

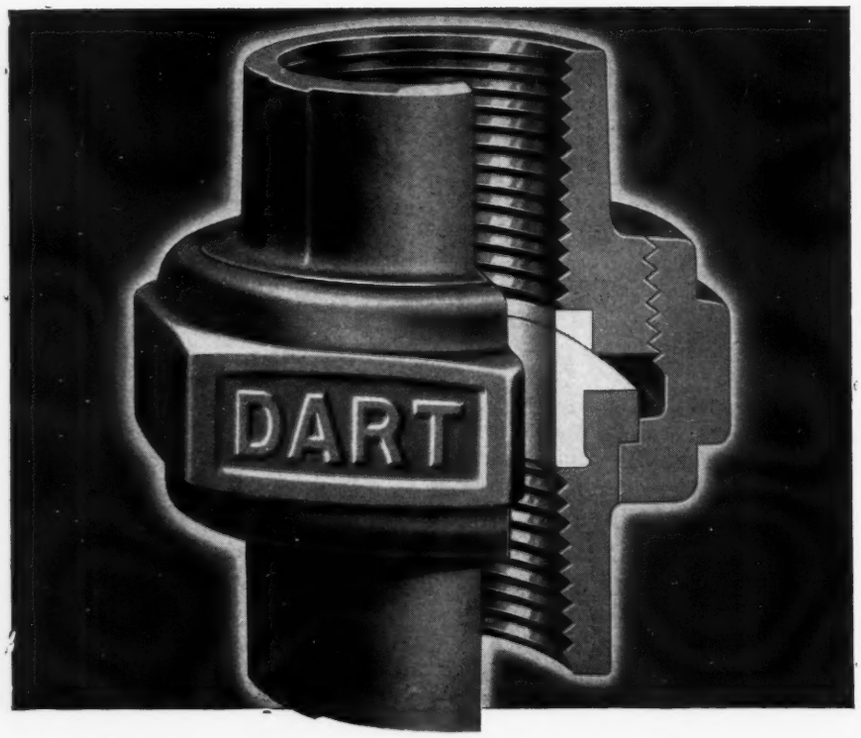
Consult your nearest J-M District Office today about your Magnesia requirements, or write direct to Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE
INDUSTRIAL INSULATIONS
For every temperature . . . for every service condition

JOHNS-MANVILLE JM PRODUCTS

You're Sittin' Pretty If You Have Any Old

DART UNIONS You Can Put Back to Work



Lucky is the man who has some old Dart Unions kicking around his plant. For you'll find that those old discards can be put back on the job with excellent results. And this is right in line with Uncle Sam's program. The more metal you save, the more he can use for his guns, tanks, ships, and planes.

The reason you can re-use Dart Unions again and again and still get a stay-tight fit is an old story. Dart Unions are long-service Unions. Their bronze, matched seats are ground to "true-ball" surfaces—and their air-refined, malleable iron nuts and bodies stand up under rough handling.

So get out your old Dart Unions and let them work side by side with the new ones you buy from your supplier.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

Readers' Problems

(*Continued from page* 128)

affecting the shaft alignment, but comparatively large belts may cause misalignment, especially if they must be run without slack and all pull in the same direction.

It is obvious that the position of shafts in relation to others, must remain the same whether belts are on or off, but it is a question whether the unloaded alignment position will be retained after heavy belts under any considerable tension are placed on the pulleys.

In new installations, shafting is generally aligned when first hung and then rechecked after the belts have been put in place. In practice it is sometimes necessary to handle maintenance work within such limited periods that no time can be allowed for removing and replacing the belts. Much of this work must therefore be done with all belts in place.

Jersey City, N. J.

I S CHAMBERLAIN

Shafting Must Sustain Belt Loads

ALL BELTS, PULLEYS OR GEARS should be released of strain before attempting to line up any shafting. If the shafting is already in place with its equipment it may be inconvenient to apply the usual method of running a steel wire along near the floor level and using plumb-bobs. In that case a line parallel and level with the shaft can be used for checking.

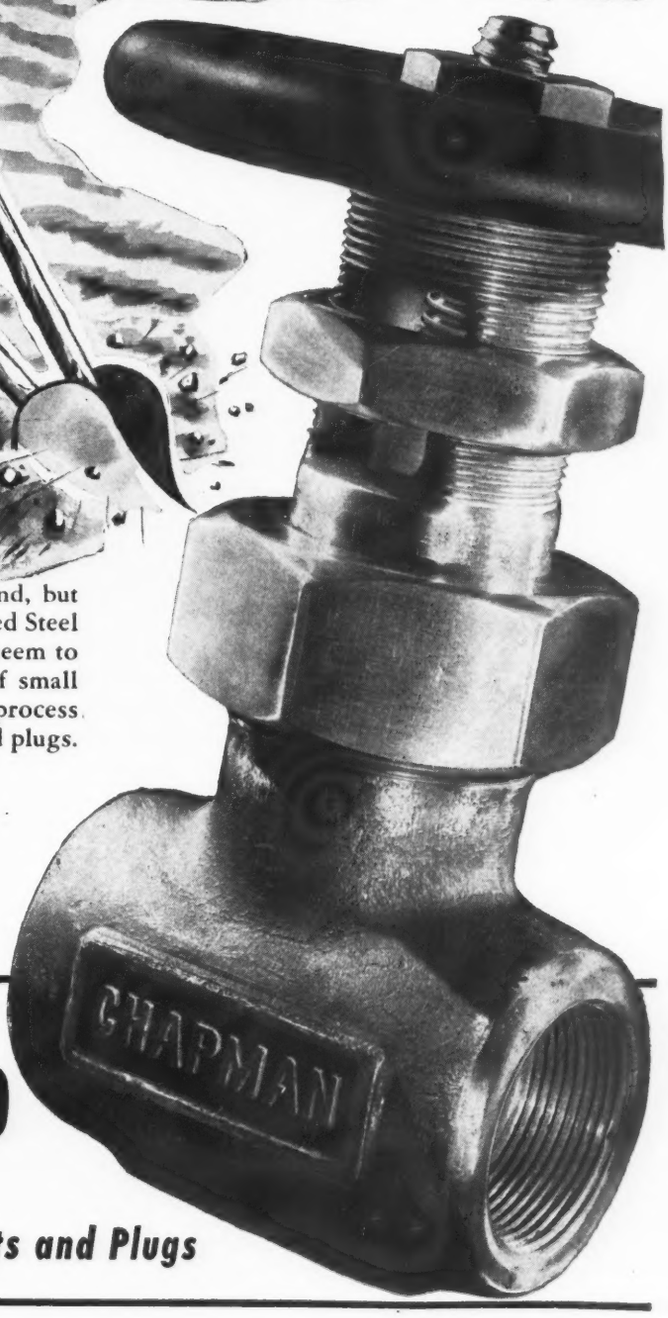
All coupling bolts should be removed from flanges and feeler gages inserted between the faces. This will detect any out-of-true, which causes vibration or heating of bearings, etc. Try the feeler gages between the flanges and a steel straight-edge laid across them, turning the shaft to various positions. If the flanges are true, the feelers will not enter between the straight-edge and the flange.

We have found it convenient when using plumb-bobs for this work to hang them submerged in a pail of heavy oil. This eliminates any tendency to swing while measurements are being taken.

For vertical alignment a millwright's level may be used on the shaft or it

"I'm gonna plug him right here...
'TAINT RIGHT TO LIVE FOREVER!"

You might get tired of having great-granpop around, but you'll never get tired of having Chapman List 960 Forged Steel Valves on your lines. And these small valves sure do seem to live forever . . . *long outlive* any other similar type of small valve. That's because of the new exclusive Chapman process that superhardens the renewable stainless steel seats and plugs. All the old familiar small-valve troubles are out when List 960 goes in. Prove it for yourself, on any line from ¼" to 2" . . . at any pressure up to 800 lb. at 750° F., or any cold working pressure up to 1500 lb. Inside or outside rising stem models. Write. The Chapman Valve Mfg. Co., Indian Orchard, Mass.



. . . and it's the same way with

CHAPMAN LIST 960

SMALL GATE VALVES

with Superhardened, Long-Lived Seats and Plugs

★ Simple
★ Rugged
★ Reliable
★ Made in U. S. A.

. . . the JONES heavy duty HAND TACHOMETER

Here is a rugged American-built Hand Tachometer . . . available for delivery, in accordance with your priority rating.

We suggest the Jones Heavy Duty Hand Tachometer for indicating rpm and surface speeds of all types of machinery in which the moving parts are readily accessible.* It is built to "stand the gaff" and maintain accuracy in hard, everyday service. Single and triple range models up to 12,000 rpm. Instruments are furnished complete with carrying case, including extra tips. Rubber-tired wheel for measuring surface speeds available at slight additional cost.

*Where moving parts are not readily accessible, as in turbines, centrifugal pumps and other totally enclosed machines, and also for measuring vibrations per minute, we recommend our Frahm Vibrating-Reed Tachometers. Ask for Bulletin 1590-P.

Write for new descriptive Bulletin 1710-P

James G. Biddle Co.
1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

may be convenient to use a surveyor's transit.

Be sure that all countershafts are in line with the main shaft, that pulleys are of the proper bore for the shaft and balanced, and that belt joints are even and smooth.

Kearny, N. J. GEORGE MCNALLY

Belt Stress Causes Misalignment

CAA SHOULD CHECK the bearings and supports so as to eliminate handling the shafting too much.

It is not possible to align a shaft with the belts on the pulleys and still have a true shaft alignment. If the ends of the belts are cemented together, it is possible to let this belting hang loosely in place while aligning the shaft. Then the belts are ready to be put on the pulleys: this is the proper procedure because the belts put a strain on shaft alignment if the belting is of the proper length.

The pulley used affects the true running of the belt after it is put on the line. Some split pulleys, if not put on the shaft correctly, will give a lope in the running of the shaft at this point. Allowing the belts to remain on the pulleys will cause misalignment to show up at flange couplings when the bolts are removed. With the belts on the pulleys the belt has a lifting effect, but if it is allowed to hang on the shaft there is no strain and the shaft can be aligned properly.

After the shaft is in position, check shafting, pulleys, and bearings; then put belting in place and make a test run for approximately an hour then check for warm bearings on shafting or motors.

If the shaft is aligned correctly but the bearings and pulleys installed haphazardly the drive is going to give trouble in a short time. This will require a complete rechecking of the equipment with its loss of time as well as added expense.

Philadelphia, Pa. T F CUNNINGHAM

Thanks, Anyway

The editors wish to acknowledge additional answers received from C C Clark, Saint John, N. B.; W T Mullen, Philadelphia, Pa.; Carl Bachmann, Schenectady, N. Y.; Frank Haworth, Cambridge, Mass., and Frank Avis, Clarkdale, Arizona.

Types, Sizes and Weights for Every Pipe Welding Need

TUBE-TURN
WELDING FITTINGS

180° SHORT RADIUS RETURN

180° LONG RADIUS RETURN

REDUCING OUTLET TEE

STRAIGHT TEE

45° LONG RADIUS ELBOW

90° SHORT RADIUS ELBOW

90° LONG RADIUS ELBOW

180° EXTRA LONG RADIUS

STRAIGHT LATERAL

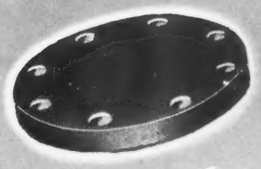
WELDING RING

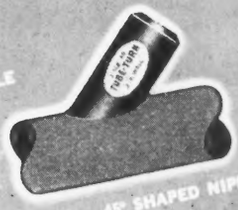
ECCENTRIC REDUCER

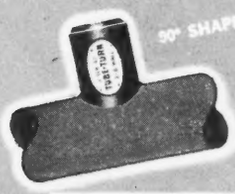
CONCENTRIC REDUCER

LAP JOINT STUB END

CAP


BLIND FLANGE

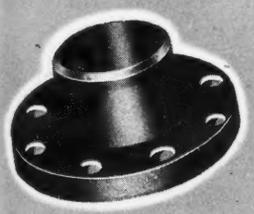

45° SHAPED NIPPLE

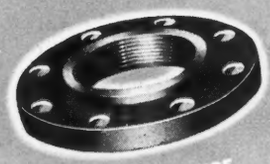


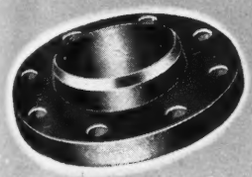
STRAIGHT CROSS

SADDLE

SLIP-ON FLANGE


WELDING NECK FLANGE


SCREWED FLANGE


LAPPED FLANGE

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

TYPE OF FITTING	DESCRIPTION	STANDARD WEIGHT	EXTRA STRONG	SCHEDULE 160	DOUBLE EXTRA STRONG
ELBOWS	90° LONG RADIUS	½"-24"	¾"-24"	1"-12"	1"-8"
ELBOWS	90° SHORT RADIUS	1"-24"	1½"-24"		
ELBOWS	45° LONG RADIUS	½"-24"	¾"-24"	1"-12"	1"-8"
RETURNS	180° LONG RADIUS	½"-24"	1"-24"	1"-12"	3"-8"
RETURNS	180° SHORT RADIUS	1"-24"	1½"-24"		
RETURNS	180° EXTRA LONG RADIUS	1"-2½"	1"-2½"		
TEES	STRAIGHT	¾"-24"	¾"-24"	1"-12"	1"-8"
TEES	REDUCING OUTLET	¾"-24"	¾"-24"	1"-12"	1"-8"
REDUCERS	Concentric and Eccentric	1x⅜"-24x20"	1x⅜"-24x20"		1x⅜"-12x10"
CAPS		1"-24"	1"-24"		1"-24"
STUB ENDS	LAP JOINT	1"-24"	1"-24"		
NIPPLES	Shaped, 90° or 45° to Header	1¼"-12"	1¼"-12"		
SADDLES		2"-24"			
LATERALS		1¼"-24"	1¼"-24"		
CROSSES		1¼"-24"	1¼"-24"		
RINGS		¾"-12"	1¼"-12"		
		150, 300, 400†, 600 and 900* Lb.		1500 Lb.	2500 Lb.
FLANGES	WELDING NECK	½"-24"		½"-24"	½"-12"
FLANGES	SLIP-ON	½"-24"		½"-12"	½"-12"
FLANGES	LAP JOINT	½"-24"		½"-24"	½"-12"
FLANGES	THREADED	½"-24"		½"-12"	½"-12"
FLANGES	BLIND	½"-24"		½"-24"	½"-12"

† Dimensions on sizes thru 3½" same as for 600 lb. flanges.

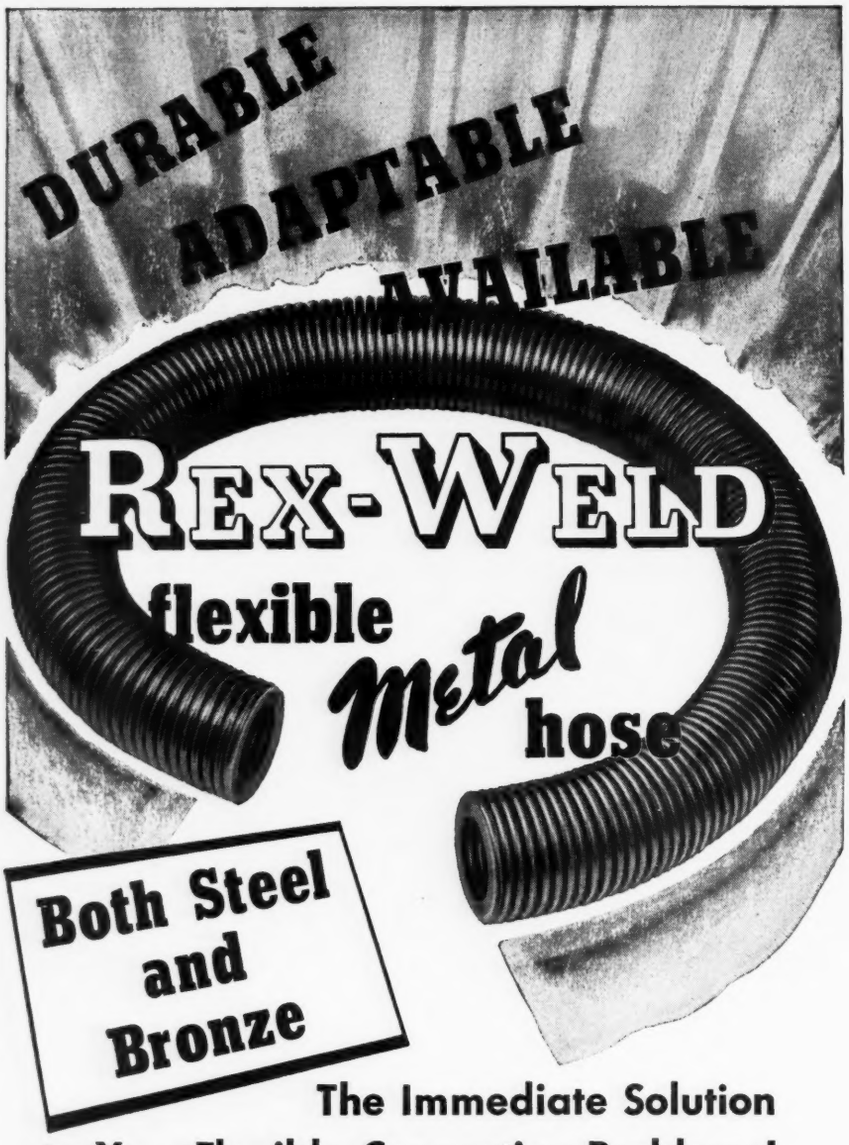
* Dimension on sizes thru 2½" same as for 1500 lb. flanges.

For sizes of light gauge and super-weight fittings, forged steel flanges, and for complete specifications on all Tube-Turn fittings, refer to *Tube-Turn Catalog.*

TUBE-TURN TRADE MARK *Welding Fittings*

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

TUBE TURNS, INC., LOUISVILLE, KY. *Branch offices:* **New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Tulsa, Houston, Los Angeles, Washington, D. C.** *Distributors in all principal cities.*



The Immediate Solution to Your Flexible Connection Problems!

Type RW-81
(annular corrugations)

Type RW-91
(helical corrugations)

REX-WELD* (corrugated) *Flexible METAL Hose

Sizes from ⅛″ I. D. to 4″ I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F. One-piece, all-metal construction. Continuous lengths to 50 feet.

Rex-Tite Mechanical (Re-attachable) couplings; solder couplings; brazed and welded couplings and flange assemblies for Rex-Weld Flexible Metal Hose. ***Complete Data on Request.***

Use our production capacity to increase your production

CHICAGO METAL HOSE CORPORATION

General Offices: Maywood, Illinois
Factories: Maywood and Elgin, Illinois

New Equipment

(*Continued from page* 140)

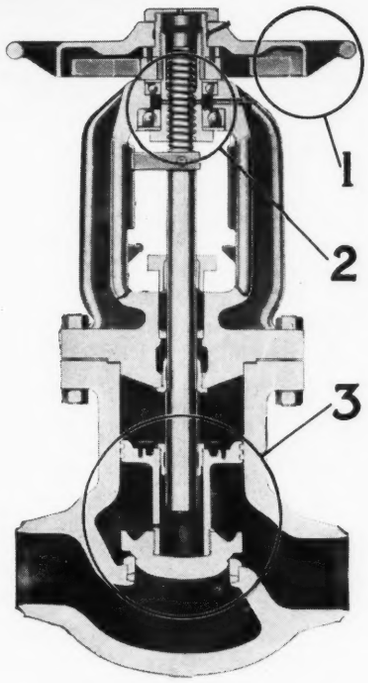
brass, copper-nickel and Monel pipe can be used. The valves can be used for steam, oil, hot- or cold-water, compressed-air, acid, Freon and other applications. *Fairbanks Co, New York, N. Y.*

Extinguishing Powder

WHIPPET IS CLAIMED to be effective against all fires, such as gasoline, benzine, naphtha, tar, grease, oil, electric, acetylene gas, chimney and forest fires, etc. No equipment is required, and the powder is said to be non-poisonous and to contain no noxious gases. *The Halco Chemical Corp, 551 Fifth Ave, New York, N. Y.*

Voltage Breakdown Tester

INSTRUMENT CONSISTS essentially of a stepup transformer accurately controlled by a variac; current-limiting resistors safeguarding equipment in the event of a dead short; a relay indicator by means of a panel light when there is a breakdown; a meter providing direct-reading voltages, and the rectifier and filter circuit providing high-voltage dc current. A self-incorporated safety switch makes the power supply inoperative if chassis is removed from case or otherwise disturbed. High voltage is applied by a suitable fixture and by a test prod connecting with proper receptacle on the instrument panel, as well as by a second connection to the ground-binding post on the



1 For quick emergency operation and fast, drop-tight closure during boiler tests, no device is so effective as the famous Edward patented Impactor handwheel.

2 Edward's exclusive EValthrust ball bearing yoke construction. Double combination angular-radial ball bearings aid in easy valve operation.

3 Hour glass disk piston assembly gives maximum flow area above as well as below the disk. Internal body contours minimize turbulence.

(Valve illustrated has welded-in Stellite seat, welding ends)

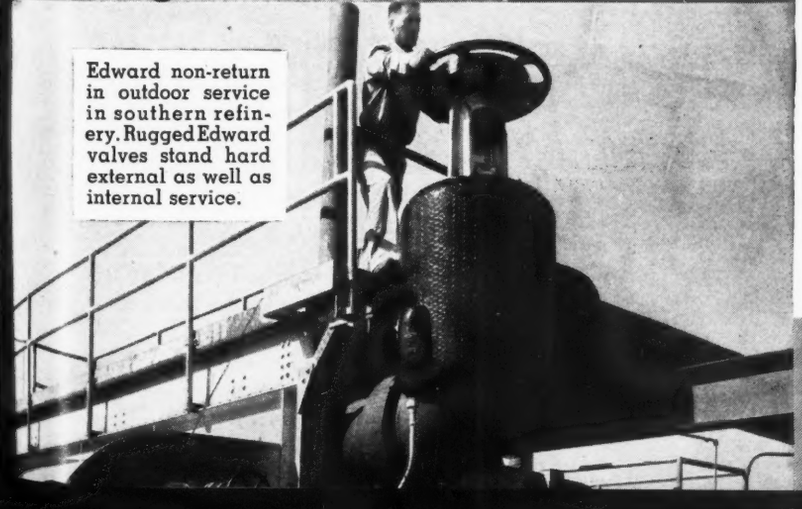
Four giant Edward welding end non-return valves for 1500 lb, 950F service, each equipped with Edward Impactor handwheel. A sharp turn of the wheel delivers equal sledge-hammer blows against opposite ends of cross arm.

Low Pressure Drop...

FAST, SURE CUT-OFF...

THAT'S EDWARD NON-RETURNS!

Good non-return valves start with sound bodies and bonnets. Typical of Edward care is the continuous use of radiography to inspect castings. This is but one of many tests Edward castings must pass. Temporary test flanges are machined off after hydrostatic test.



Edward non-return in outdoor service in southern refinery. Rugged Edward valves stand hard external as well as internal service.

IN NON-RETURN VALVES the two most important things are free flow with low pressure drop, and fast, sure closing action in emergency. Edward non-returns excel on both counts.

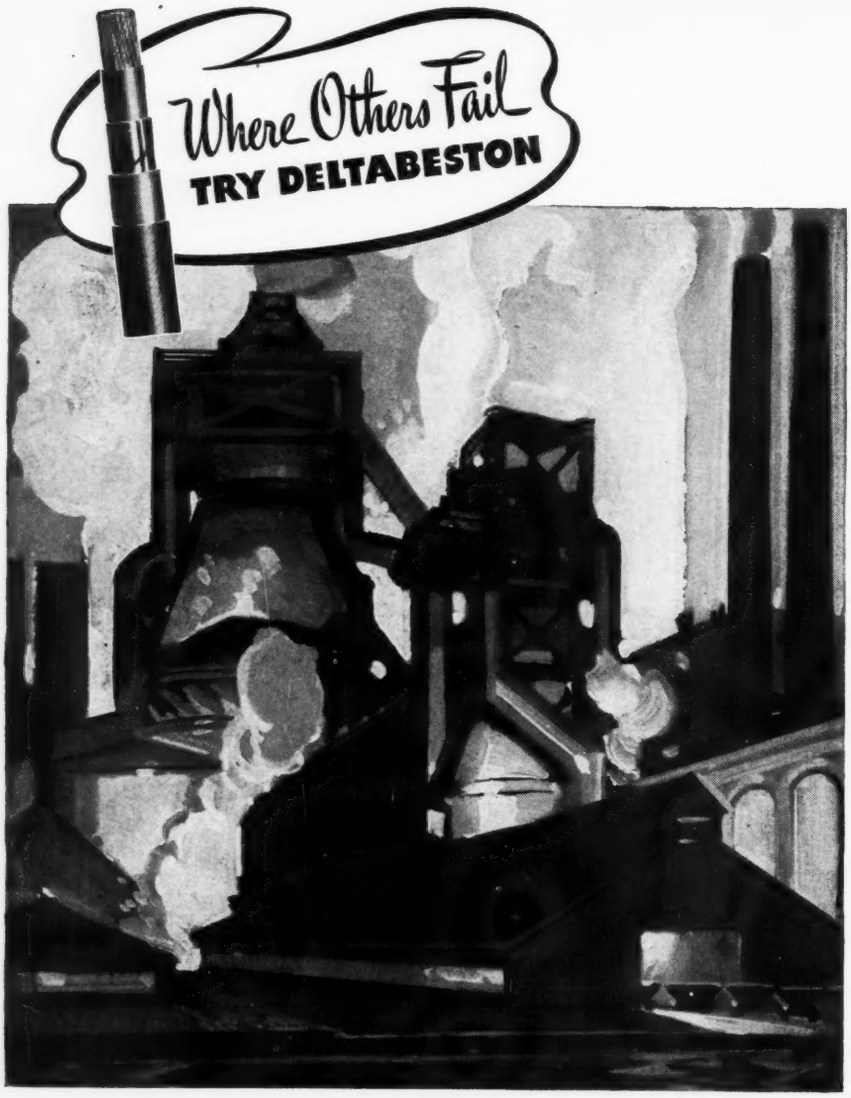
Streamlined internal contours, without eddy-producing spiders and disk cages, cut pressure drop to a minimum. Yet Edward cast body ribs maintain three-point guiding to keep the disk in proper position to enter the seat at all times. The distinctive Edward "hour-glass" disk-piston assembly leaves steam free to follow the easiest route to valve outlet without undue turbulence.

Edward's patented Impactor handwheel and EValthrust yoke bushing make fast valve operation in emergency or for boiler hydrostatic tests unusually simple. No other device is so effective.

Edward non-return valves are built for 150 to 1500 lb service with flanged or welding ends. Hard surfaced, integral "Intex" seats available.

THE EDWARD VALVE & MFG. CO., INC.
1220 WEST 144TH STREET
EAST CHICAGO, INDIANA

EDWARD
Steel CAST AND FORGED
VALVES



When the Heat's On....

That's when it pays to have Deltabeston Wires and Cables in your industrial equipment. Heat . . . humidity . . . and deterioration don't have a chance to upset production schedules or cause costly repairs.

Deltabeston is moisture-proof, flame-proof and durable. It is built to stand peak load operations, day after day, and will give safe, uninterrupted service. Don't take chances with ordinary insulations when the "heat is on." Put in Deltabeston for protection.

Deltabeston and Glass Insulated Cables are distributed nationally by Graybar Electric Co., G-E Supply Corp. and other G-E Merchandise Distributors. For complete information get in touch with your nearest Distributor or write to Section Y922-52, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

panel. The instrument connects with usual 110-volt 60-cycle ac. *Industrial Instruments, Inc, 156 Culver Ave, Jersey City, N. J.*

Power Trucks

NEW TRUCKS lift from 2000 to 7000 lb. using an hydraulic vane-type pump, driven by a special series-wound motor. The machines have four speeds forward and four speeds in reverse; drive is on the front wheels, with rear wheel steer. Drive axle is Clark special double-reduction gear and pinion, mounted on ball and roller bearings. Drive motor

is mounted directly to axle and drives through ring gear and pinion. Standard equipment includes hydraulic brakes, centrally located control levers, spring-mounted, rubber-cushioned seats, disk wheels, electric horn. Motors and electric-control equipment are supplied by General Electric. Customer has choice of Edison alkaline battery or any standard make of acid battery. *Clark Tructractor Div, Clark Equipment Co, Battle Creek, Mich.*

Flashing Method

FLEXROCK FLASHING method takes place of lead or copper. Maker says that inexpensive application makes a permanent replacement and adheres tightly to all types of industrial roofs, including corrugated iron. Quick brush application can be used over entire roof with good results. Said to provide safe leak-proof repairs to wornout flashings. *Flexrock Co, 23rd & Manning Sts, Philadelphia.*

Pressure Indicating Gauges

DEVELOPED FOR USE in pressure indicating gages, new type of gearing is made in the form of a patent cam and roller movement. This movement employs a sector-shaped driving cam and a driven helical roller. One end of pivoted cam is linked to tip of Bourdon tube, while other is aligned with and fits freely into roller thread. Hair spring limits point

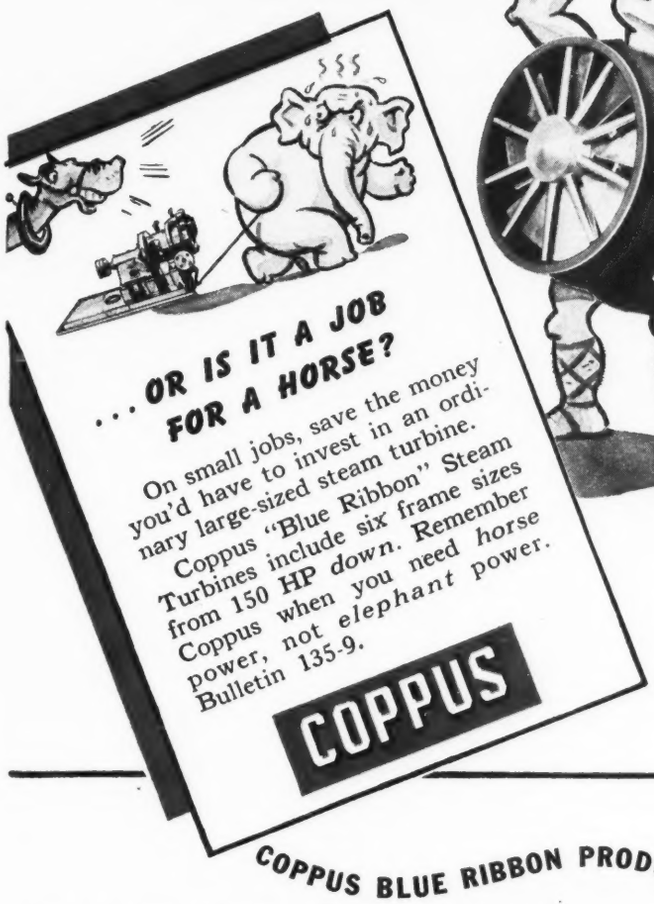
50,000 LBS. CONTINUOUS GUARANTEED
70,000 LBS. CONTINUOUS DELIVERED

Here's help in getting more out of your boilers burning natural gas.

Coppus-Dennis Fanmix Gas Burners helped a recent boiler installation exceed its guarantees by a very welcome margin. The maximum guaranteed capacity of the boiler was 50,000 pounds continuous and 60,000-pound 15-minute peaks. Actual average hourly load was 70,000 pounds with peaks of several hours' duration of 75,000 pounds. Air heater exit gas temperature was much lower than guarantee figure, showing complete combustion in the furnace. That is performance that means a lot in times like the present.

Bulletin 410-3 describes perfect gas-air ratio . . . instantaneous combustion . . . small combustion space . . . absence of "hot spots" . . . and dozens of other features. It's a Coppus "Blue Ribbon" Product. Check the coupon.

COPPUS


. . . OR IS IT A JOB FOR A HORSE?
On small jobs, save the money you'd have to invest in an ordinary large-sized steam turbine. Coppus "Blue Ribbon" Steam Turbines include six frame sizes from 150 HP down. Remember Coppus when you need horse power, not elephant power. Bulletin 135-9.
COPPUS

COPPUS BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY . . . ENGINEERED FOR YOU

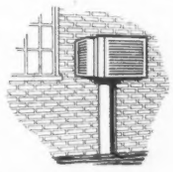
COPPUS ENGINEERING CORPORATION

329 Park Avenue, Worcester, Mass.

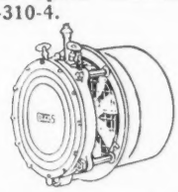
Sales Offices in THOMAS' REGISTER. See Sweet's Catalog for other "Blue Ribbon" Products.

You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

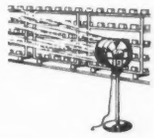
(Check the ones you want)



☐ Coppus Air Filters. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.



☐ Coppus Type C Turbo Blower. For undergrate draft. Bulletin 145-6.



☐ Coppus Heat Killers. High speed blasts for cooling and drying furnaces, motors, generators, products, etc. Bulletin 160-5.

☐ Coppus Welding Exhauster. For exhausting welding fumes and other injurious gases from confined working spaces. Bulletin 168-1.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

☐ Coppus Steam Turbine (described in this ad).

NAME .....

COMPANY .....

ADDRESS .....

Minimize the chances of interrupted, inefficient plant operation by sampling your coal the "STURTEVANT WAY" . . .

It's as simple as A-B-C to know your BTU's when you sample your coal with the IMPROVED STURTEVANT AUTOMATIC COAL CRUSHER AND SAMPLER—and it's a lot faster and more accurate to get the information you need the "STURTEVANT WAY" than by old fashioned, slow, hand sampling guesswork.

You'll *need* to *know* your BTU's in the coal you get tomorrow because it's likely to be quite different from the kind and quality you're getting today. Heat value, dollar value, performance value may not check with what you've been accustomed to burn in the past—yet you must keep your plant efficiency *up* and the chances of interrupted service *down*.

With Sturtevant sampling you will find the job of adjusting your plant to meet changes in coal characteristics far easier and be in much better position to insure constant operating service. With demand for power ever increasing, you can't risk shut downs.

Know what you're buying and pay for what you get . . .

With "Sturtevant" sampling you can buy your coal on a strict B.T.U. basis, avoid paying for impurities, and be assured of accurate heat measurement while eliminating 32 of the 34 operations ordinarily required by hand sampling methods. Actual experience by users discloses outstanding savings in time, money and labor.

INVESTIGATE IMMEDIATELY BY SENDING FOR FREE COPY OF BULLETIN 85

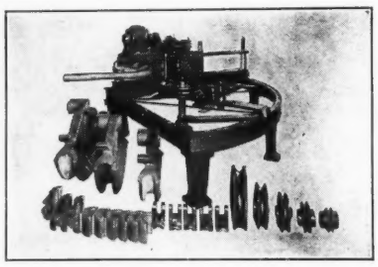
Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

of contact between cam and roller to only one side of each element, and prevents backlash. Gages are also provided with recalibrating mechanism by means of which it is possible to reset the pointer to zero to correct any drift or set of the Bourdon tube. Back-adjustment screw available on all large gages, and effects positive recalibration without necessity of opening case or removing gage from service. Such recalibration disturbs neither the cam and roller movement nor the Bourdon tube—the angularity of the linkage remains unchanged. *Certified Gauge & Instrument Corp, Long Island City, N. Y.*

Pipe Bender

TAL'S PRESTAL PIPE BENDER will bend, according to maker, all iron and steel pipe, as well as solid bars of mild steel from 3/8 in. to 2 in. in three minutes or



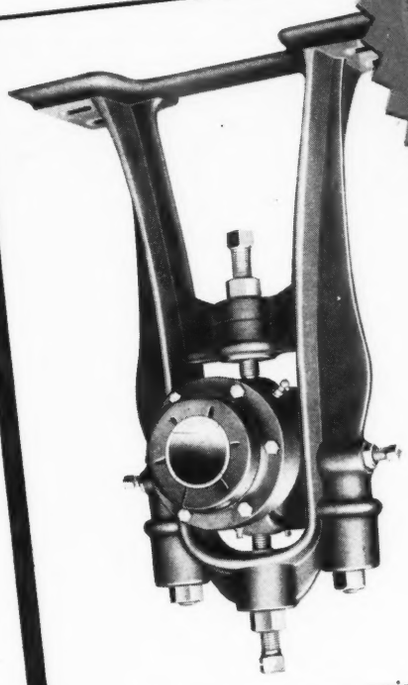
less. Hydraulic power is used to bend pipe. Unit is adaptable to any job with quick changeover to various pipe sizes. Quick-release device enables operator to remove pipe instantly, after bending. *Tal's Prestal Pipe Bender, Inc, Milwaukee, Wis.*

Ventilators

DESIGNED TO PREVENT transmission and reflection of illumination from the building interior, or the reflection of light from the night sky, Carrier war plant ventilators are available in three types as follows: (1) Carrier exhaust ventilators, to remove hot, humid air from the plant, exhausting it at the roof; (2) Carrier supply ventilators, to replace the excessively hot plant air with relatively cooler air from outdoors, drawing the air in at the roof and supplying it with uniform circulation to the working areas; (3) Carrier tempering ventilators, which warm and deliver air to the plant, drawing air in at the roof and providing needed ventilation with tempered air to prevent drafts and cold spots in the plant during cold weather. Each of the types described comes in three standard capacities—10,000, 15,-

Save power for Victory—reduce cost for post-war competition with Timken Bearing Equipped transmission units.

TO ASSURE VICTORY
BUY UNITED STATES WAR SAVINGS BONDS & STAMPS



Medart Line Shaft Hanger equipped with Timken Tapered Roller Bearings.

Medart Line Shaft Hangers unit showing the Timken Bearing Application.

Medart Type SS Pillow Block cut away to show the Timken Bearing Application.

Power waste is bad enough in normal times; it's a positive crime now, when every single kilowatt and horse power is so urgently needed for the war effort.

Are you permitting vital power to be burned up by obsolete, friction-ridden line shaft hangers and pillow blocks—mechanical saboteurs doing their dirty work unnoticed and unheeded?

How much of the power you are paying for is actually being used? How much of it never reaches its destination?

It will pay you to check up *now* and to replace the obsolete power wasters with modern power savers—Timken Bearing Equipped.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

FULLER ROTARY COMPRESSORS AND VACUUM PUMPS

SIMPLICITY OF DESIGN . . . AN OUTSTANDING FEATURE

The fewer moving or wearing parts that make up any piece of equipment, the more continuous service at the lowest operating cost. Fuller Rotary Compressors and Vacuum Pumps are an outstanding example of simplicity of design . . . only three moving parts: rotor, bearings, blades.

Ruggedly constructed, they will withstand long, continuous service and, after severe, gruelling operating periods, if inspection and check-up is desired, the machine design permits doing this easily and with a minimum loss of time.

Shut-downs are costly . . . lost time can never be recovered . . . install Fullers for day in and day out, continuous service.

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA
Chicago: 1144 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg.

C-72

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

000 and 20,000 cfm. The units may be used singly or in multiple. *Carrier Corp, Syracuse, N. Y.*

Automatic Synchronizer

TYPE XK AUTOMATIC SYNCHRONOUS provides practical and inexpensive device for automatically synchronizing small generators. Synchronizer is limited in use to ac machines having a kva rating of 250 or below, and a voltage rating of 600 or less, with a suitable governor and fast-closing machine contactor or breaker. One synchronizer and control switch is used for opening machine contactor coil circuit when it is held closed magnetically. If contactor is held closed by a latch and tripped electrically, switch is used in the trip-coil circuit. Synchronizers available for 50-60 cycle service. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Magnetic Separator

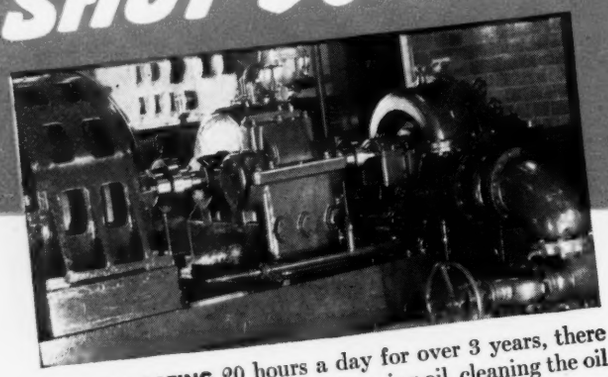
TYPE "R" MAGNETIC SEPARATOR NOW has modern appearance in so far as structural frame design is concerned. Elimination of much of heavy framework which formerly supported coils has been accomplished without any weakening in the unit structure Separator employs cross-belt method of magnetic separation, material being fed by a special feeding device onto main belt and magnetic portions being intercepted and carried to special chutes on the side. In general application of separators of this class either a single magnet unit or one having a sufficient number of magnets to effect the desired separation can be furnished. *Stearns Magnetic Mfg. Co, Aurora, Ill.*

Portable Service Stations

PORTABLE SERVICE STATIONS are complete lubrication departments ready for instant operation, for mounting on hand or electric trucks, to enable on-the-spot lubrication of equipment in all parts of the plant. Standard models of four- and six-unit capacity include high-pressure pump with 20 ft of hose on reel for power lubrication of pressure-gun fittings, and low-pressure power pumps with 15 ft of hose on reel for dispensing gear-lubricants and machine oils. Two or more hand-operated low-pressure pumps for dispensing lubricants and oil, and hand-operated pumps for loading hand guns, are part of equipment. Outstanding feature of the Advance model is a power head of magazine type which can be readily transferred from one pump to another, making each a power-

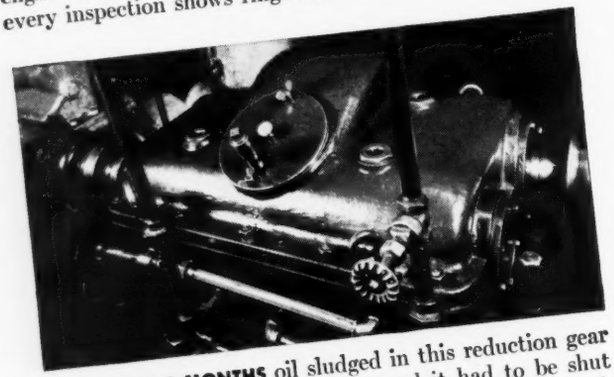
SUGGESTION BOX
"Help the W.P.B. production drive for plant efficiency"
10 ways Standard Lubrication Engineers have helped plants increase efficiency
SEE IF THESE EXAMPLES GIVE YOU A SUGGESTION FOR YOUR PLANT—
STANDARD OIL COMPANY (INDIANA)
LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION

Save SHUT-DOWNS



AFTER OPERATING 20 hours a day for over 3 years, there have been no shut-downs for changing oil, cleaning the oil system, or oil treating, in the turbine, gear case, or generator pictured above. Nonpareil Turbine Oil was put in when they were installed. It is guaranteed against excessive acidity increase, and will not form sludge. Try Nonpareil for full-time operation from your turbines.

IT SEEMED TO THE OPERATOR in a Wisconsin light plant that age was creeping up on his 15-year-old Diesel. It was losing its pep. But that didn't explain why each inspection also showed rings stuck and signs of blow-by on a five-year and a two-year-old engine. A test was made of Nonpareil Diesel Oil. With it, even the 15-year-old engine doesn't act its age. It has picked up power and every inspection shows rings free on all three units.



EVERY 3 TO 6 MONTHS oil sludged in this reduction gear at a North Dakota power plant and it had to be shut down for cleaning and changing oil. Stanoil was tested. It ran a full year before it was replaced and even then no deposits had formed. The saving in oil costs may be incidental today, but cutting shut-down time for cleaning reduction gears to one-fourth is important.

Save MAN-POWER

THE FIRST GALLON of Stanodrip tested in bottle oilers on this homogenizer lasted 10 days. A gallon of engine oil previously used never lasted over two days. Just this simple test at a Lubrication Engineer's suggestion saved this Wisconsin plant 80% in oil and lubricating time.

BEARINGS ON KILN CARS were lubricated every 60 days and required 200 pounds of grease. This high consumption of grease and waste of oilers' time might have gone unnoticed except for the excessive amount of grease on the kiln floor. A Standard Oil Engineer tackled the problem. Temperatures were analyzed. The right grade of high temperature Superla "X" Grease was tested. With it, cars are lubricated once every *six months* instead of 60 days. Only 175 pounds of Superla are needed each time. Oiler's time and lubricant were saved and a hazardous plant condition was eliminated.

* * *

"KEEP OILERS ON THE RUN" was the superintendent's answer to high bearing maintenance caused by dusty plant conditions in a fertilizer plant. Crusher, conveyor, and other bearings were lubricated four times a day. Both labor and grease costs were high. Did a Standard Lubrication Engineer have a better answer? He did. A higher quality grease—Superla. It stayed in the bearings and kept dust out. Greasing was needed only once a day. The saving in grease, labor, and maintenance more than paid the difference in cost of the higher quality lubricant.

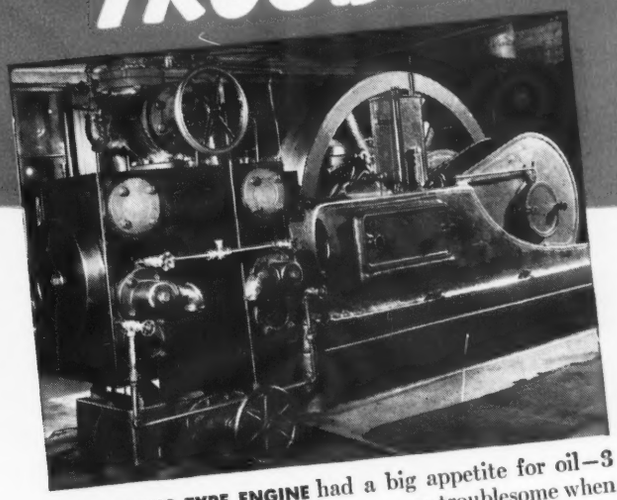
Save MAINTENANCE

HIGH TEMPERATURES and abrasive dust complicated the lubrication of girth gears on a cement kiln in Michigan. Several gear lubricants were tried . . . some were thrown off because of the high temperature—others balled-up from the dust and dropped off—none eliminated the metal-to-metal chatter and wear.

The plant superintendent welcomed a test suggested by the Standard Lubrication Engineer. Calumet Viscous Lubricant was put on the hottest and dustiest locations —and it *stayed* there. Drippage was eliminated, wear was reduced. Gears needed greasing just one-third as often.

THE STEP-UP IN PRODUCTION in a midwest plant increased the number of bearing failures. There were over 500 anti-friction bearings in motors ranging from ¼ to 275 H.P. They operated under widely varying temperatures. Special lubricants for each condition would have been costly. A survey by a Standard Oil Engineer indicated that Stanodrip would meet all requirements. These results left no doubt: no bearing failures in eight months; less than half as much lubricant needed; and, naturally, less than half of the lubricating maintenance time.

Save TROUBLE



THIS CORLISS TYPE ENGINE had a big appetite for oil—3 quarts or more a day; oil carryover was troublesome when the steam was used for heating. Cutting down oil consumption would reduce carryover. But would the engine get adequate lubrication? The operator asked a Standard Oil Engineer to help. With the Standard cylinder oil he suggested, feeds were cut to one pint per 8-hour day, with adequate lubrication and no carryover.

HIGH TEMPERATURES in Jordan bearings worried the millwright in a Michigan paper mill. These bearings cost about $360 per set, not including lost machine time and replacement labor. A Standard Oil Engineer recommended a test of Superla Grease No. 2X. When temperatures dropped to normal on the test bearing, all Jordans in the plant were put on Superla, with the same result. Bearing failures don't worry this millwright now.

WHY EXPERIMENT? SEE A STANDARD OIL ENGINEER

Hundreds of new lubricating problems have already been solved by Standard Oil Engineers to help plants which must now conserve manpower and equipment.

Profit by the experience these Engineers have had. Take advantage of the new lubricants they have developed. Save time; get peak production from every power generating or transmission unit in your plant. Call any Standard Oil Company (Indiana) office.

CAT INEERING...STANDARD OIL COMPANY (INDIANA)...LUBRICATION ENGINEERIN

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION EN

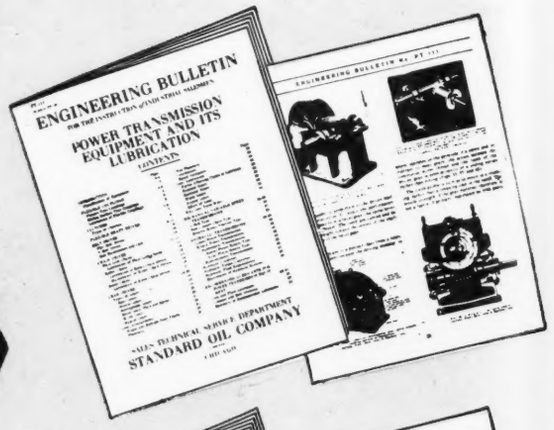
HERE'S HELPFUL INFORMATION ON LUBRICATION AND LUBRICANTS

You may have taken over new duties—new men may have been assigned unfamiliar jobs. Where lubrication is concerned, these Engineering Bulletins will be helpful. They are briefly described below. Send for any you think will be valuable to you or your men.

Where you have specific lubrication problems, call a Standard Oil Engineer. He will have information on the latest developments in methods to solve your problem.

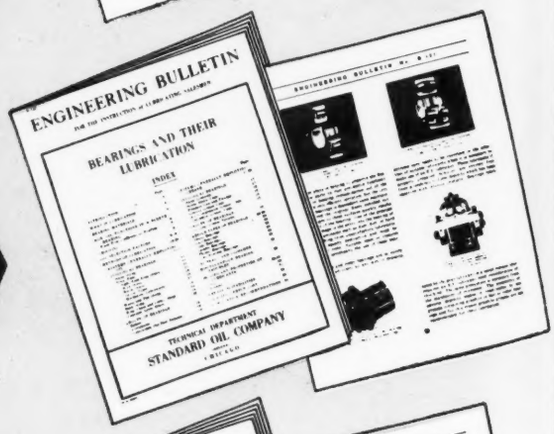
1 "POWER TRANSMISSION EQUIPMENT AND ITS LUBRICATION"

Discusses the design of various types of drives and the important factors to be considered in their lubrication to prevent excessive wear and maintenance. This not only includes the conventional chain and gear drives but also variable speed and hydraulic transmissions.



2 "BEARINGS AND THEIR LUBRICATION"

Discusses types of bearings and bearing materials—types of lubricants required by each of them—methods of lubrication—significant properties to be considered in selecting an oil or grease.



3 "STORAGE AND HANDLING OF LUBRICANTS"

Describes various causes of contamination of lubricants in storage and suggests ways to avoid it. Methods of oil room management are suggested, as well as ideas for distributing and dispensing lubricants to avoid mixing brands in application.

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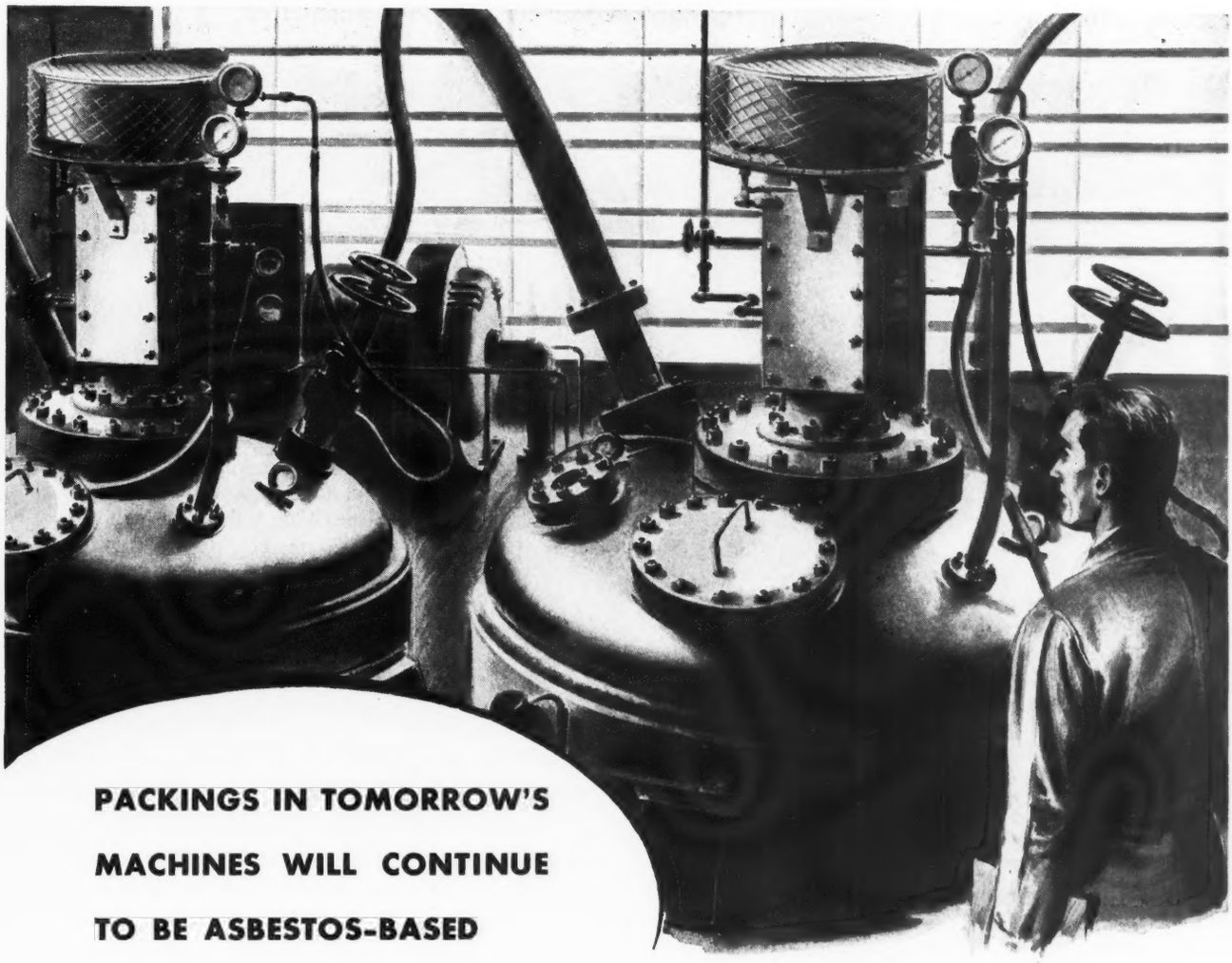

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operated pressure pump. All models are supplied with air compressor, or with air hose mounted on reel for quick connection to plant air lines. *Alemite Div, Stewart-Warner Corp, 1800 Diversey, Chicago, Ill.*

Bearing Washer

PRODUCTION-TYPE BEARING WASHER for industrial plant use has been developed so that bearings can be washed and thoroughly dried for periodical inspection and then repacked with fresh lubricant. Unit is easily portable and has sealed compartment to prevent evaporation loss of solvent solution. Provision is made for compressed-air dryer, which blows bearing dry and clean, making the whole operation complete and easy in a minimum of time. An additional unit for repacking the cleaned bearing with fresh grease is a second development. With 5 lb of clean lubricant in its base the bearing is simply placed on top of the unit and a lever forces the clean grease completely through the bearing without waste and without danger of dirt and contamination being carried in the lubricant. *Ahlberg Bearing Co, 3073 W 47th St, Chicago, Ill.*

Spectrum Chart

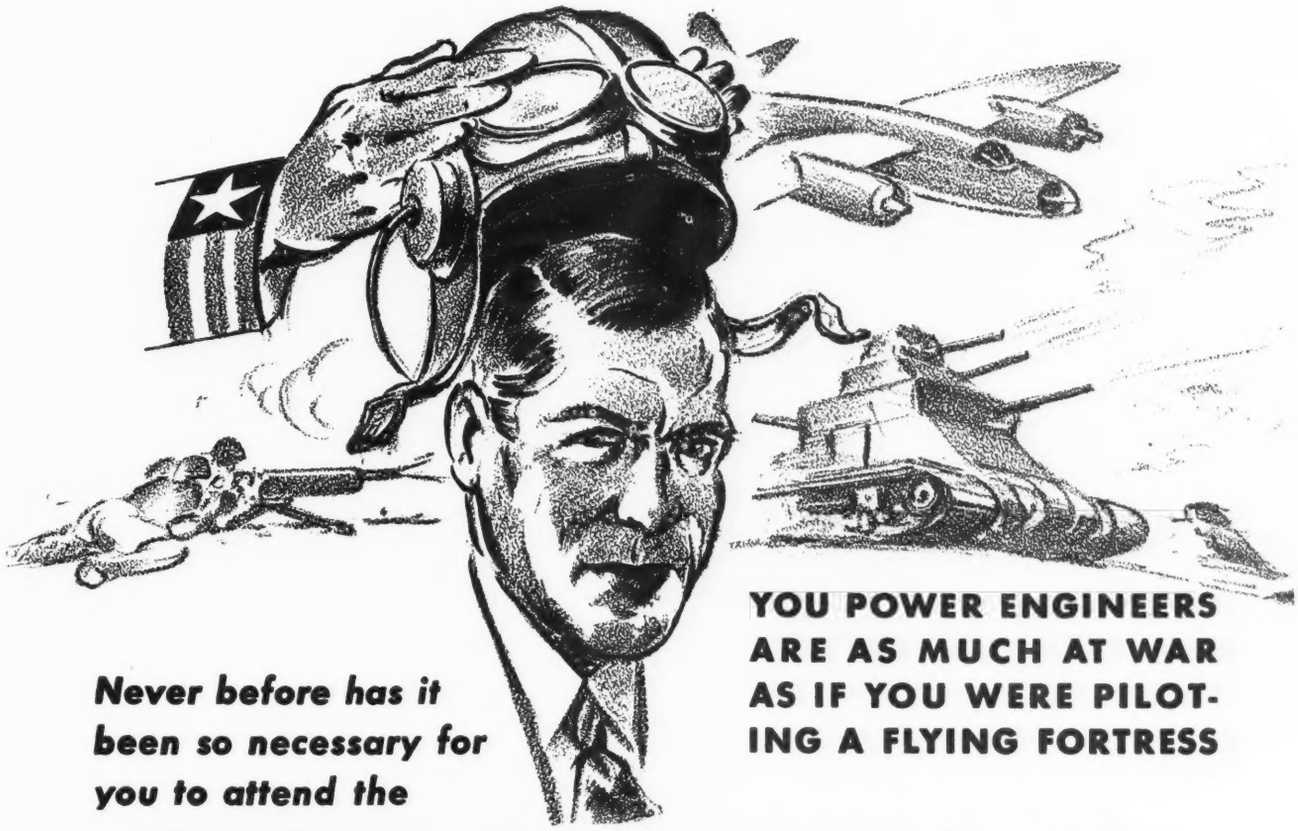
WALL SIZE CHART shows every part of the electromagnetic spectrum, of practical significance, which is analyzed in detail. Emphasis is placed on uses of each kind of radiation. Spectral terms are carefully and simply defined in a special glossary. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Portable Fluorescent Service Light

ADJUSTABLE FROM 30 in. to 7 ft, and designed to project light into many inaccessible places, new portable fluorescent service light has been adopted by industrial plants for miscellaneous use. Unit is adjustable upward or downward, horizontally or vertically, or in any angle of 180-deg arc, without the use of tools, and will illuminate any darkened area. Well-balanced cast-iron base makes light practically impossible to upset. Other features include power-factor correction for the two 48-in, 40-watt fluorescent lamps; a high-baked enamel reflector; and, if desired, a screen to protect the lens *Lumidor Mfg Co, Los Angeles, Calif.*

Welding Transformer

HEAVY-DUTY AC WELDING transformers especially designed for Uniomelt weld-



YOU POWER ENGINEERS ARE AS MUCH AT WAR AS IF YOU WERE PILOTING A FLYING FORTRESS

Never before has it been so necessary for you to attend the

POWER SHOW

This is no time for business-as-usual, conventions-as-usual, expositions-as-usual.

That's why a new kind of Power Show is planned in this unprecedented year in our nation's industrial history. That's why in the 1942 Power Show there is but one aim: to help American engineers solve their wartime production and maintenance problems — to help win the war.

Judged by advance information, by the already-announced plans of many prominent exhibitors, engineers can look forward to a unique educational opportunity. For the tone of this year's Power Show is in keeping with the gravity of the hour, grimly serious — a factual, realistic pooling of helpful, tested ideas. In place of the frills of peacetime showmanship, you are offered a clearing-house of engineering information about products and methods that have proved themselves under the necessary restrictions of total war.

You may be studying problems such as conversion from liquid fuel to coal. Or, perhaps, how to make present equipment produce more power.

There's no better, no more practical way of finding answers to the vital questions of the day than attending the 1942 Power Show. Plan to get *all* the benefits, all the inspiration that a free interchange of ideas can bring to an inquiring mind. See successful wartime power plant practice demonstrated in graphic, instructive exhibits. Discuss your problems with authoritative technical men, men to whom "High-Pressure" is an engineering term and not a selling technique.

See how....hear how....learn how at the

15th NATIONAL POWER SHOW

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING

NOV. 30 - DEC. 5 — GRAND CENTRAL PALACE, N. Y.

Managed by International Exposition Co.

4 WAYS Beckman pH CONTROL CAN LENGTHEN THE LIFE...INCREASE THE EFFICIENCY... AND REDUCE OPERATING COSTS IN YOUR POWER PLANT!

Today, with equipment hard to get and "down time" doubly costly to America's all-out production effort, it is more important than ever that you investigate the increased efficiency, the longer life, the reduced operating costs Beckman pH Control can effect in your power plant. For every critical stage of your water treating operations you can install Beckman equipment to control the pH automatically for optimum efficiency. For example...

1. Prevention of Calcium Deposits in Feed Lines, Condensers, Exchangers, Valves!

For each type of softening operation there is a definite pH at which optimum precipitation of calcium is obtained. By controlling the pH, minimum residual hardness is assured. Then, what little hardness remains is prevented from precipitating in condensers, exchangers, valves, etc., by *lowering* the pH in this part of system. *Peak efficiency can be obtained only through accurate pH control!*

2. Obtaining Maximum Efficiency in Removing Impurities Through Coagulation!

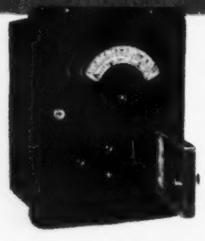
Formation of the floc is greatly influenced by the pH of the solution and the type of coagulant used. If alum is used, maximum floc is obtained at a moderately acid pH value... if sulphates predominate, a *lower* pH value gives best floc... while if chlorides predominate, a *higher* pH value—slightly alkaline—must be maintained for efficient flocculation. *Optimum sedimentation can be obtained only through accurate pH control!*

3. Reduction of Corrosion, Especially in Steam Condensate Equipment!

Rate of corrosion is a function of the pH of the water. Maintaining a high pH minimizes corrosion through formation of protective oxide coatings. pH must be sufficiently high to minimize corrosion, sufficiently low to prevent calcium precipitation (see No. 1 above). *Peak efficiency can be obtained only through accurate pH control!*

4. Protecting Costly Zeolite From Disintegration.

Zeolites are rapidly disintegrated by water with *low* pH, and are also softened and disintegrated by water of *high* pH. By Beckman-controlling pH before water enters zeolite, costly chemical losses are eliminated and vital plant economies are effected. *Here again, topmost efficiency can be obtained only through accurate pH control!*



Make vitally important savings in the cost of operating and maintaining your power plant by Beckman-controlling the pH of your feed water and steam processes. You can protect costly plant equipment against damaging calcium deposits... you can reduce maintenance and repair costs... and you can save on requirements of costly chemicals and treating materials. • Beckman pH Equipment is the leading make of pH equipment available today. It embodies many exclusive and far-reaching advancements valuable in water-treating work... and is the ONLY glass electrode pH equipment providing special High Temperature Glass Electrodes for continuous pH measurement at high temperatures. This important feature is particularly vital in power plant operations where pH must be measured continuously on high temperature fluids! • There is a size and type of Beckman pH Equipment for every power plant requirement... from portable equipment for plant and field use to completely automatic equipment for continuous pH control. Descriptive literature will gladly be sent on request! • Let our engineers make helpful suggestions on adapting pH control to your particular plant operations!

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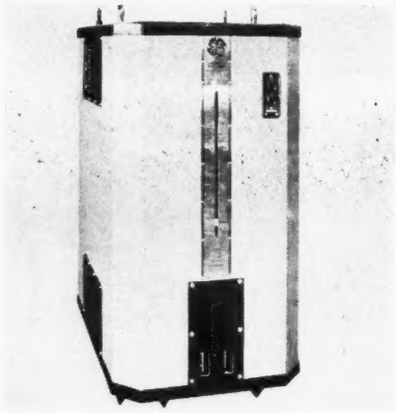
World's Largest Manufacturer of Glass Electrode pH Equipment!

Beckman THE LEADING NAME IN pH



ing announced by the company. Available in 750- and 1000-amp sizes for 220-, 440- and 550-volt power. Motor-operated, remote adjustment of the welding current permits operator to make current adjustments without leaving the work. Equipment's integral reactance design permits full output to be obtained without the use of high or multiple open-circuit taps. *General Electric Co, Schenectady, N. Y.*

Safety Cloth

CECO SAFETY CLOTH, is strong 10-mesh cotton cloth with a rough, transparent, plastic film. Cloth was designed especially for providing either a permanent or emergency "flexible" window for buildings of any kind, without the use of priority metals and materials, and to be used as a protection on the inside of glass windows to reduce the danger to persons or property should the window be shattered. Safety cloth is flexible and easy to handle, and can be cut to fit with scissor, tacked up on wooden sash, using unskilled labor. *Colloid Equipment Co, Inc, 50 Church St, New York, N. Y.*

Explosion-Proof Timers

ILLUSTRATION SHOWS explosion-proof timer suitable for operation in atmospheres containing gasoline, naphtha, petroleum, benzol, aceton, lacquer solvent, natural gas, etc. Time delay relay is laid out for panelboard mounting with the setting knob and dial projecting. *The R W Cramer Co, Inc, Centerbrook, Conn.*

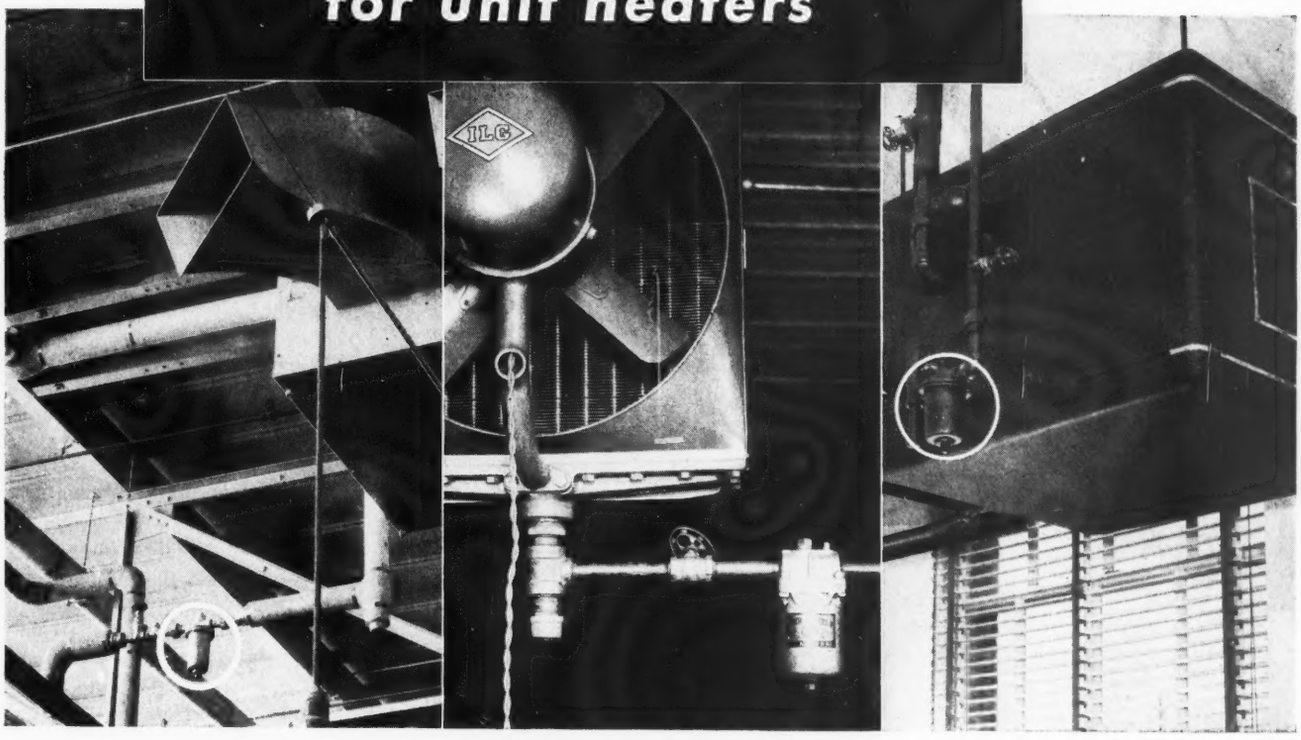
Check Valves

IMPROVED LINE of check valves furnished in wide range of metals and sizes. Designated as Williams-Hager flanged silent check valves, they are manufactured of bronze, cast iron, steel, stainless and Monel metal for pressures varying from 150 to 2500 lb to meet American standard. Sizes range from 1 to 20

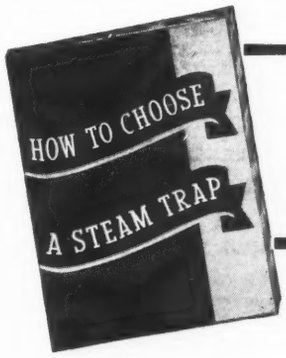
free book describes

IMPROVED TRAPPING

for unit heaters



● Do you want to know the latest methods of trapping unit heaters? Are you interested in checking the efficiency and economy of your unit heater installation? Then we invite you to send for the newest edition of "How To Choose A Steam Trap." In this book are pages devoted to improved trapping for unit heaters—the importance of correct trapping—why rapid air removal is necessary to prevent corrosion—correct method of selecting the proper size trap for all purposes to get maximum results with minimum fuel. "How To Choose A Steam Trap" is complete with tables giving specifications, capacities, and pressures. It shows you why the Super-Silvertop Steam Trap with its simplified piping, guided bucket, and smooth large passages is the modern, better trap. Send in your request today for a copy with our compliments.



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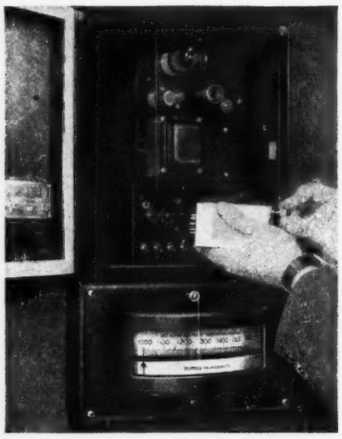
UNIVERSAL
TEMPERATURE CONTROLLERS
mean to you

1 Temperature Control Adjustment easily made from front of Controller. Control Setting may be locked inside case if desired.



2 Removing plug-in relay. Relay interchangeability permits conversion to other types of control circuits or back.

3 Plug-in Control Chassis is easily removed for inspection, replacement, or interchanging for other types of control circuits. Plug sockets may be seen above relay.

4 Interchangeable Measuring Sections permits choice of scale range or type of temperature measuring system (Potentiometer, Millivoltmeter or Resistance Thermometer).

Instantaneous control action with the famous "Electronic Principle" control system and extreme accuracy of temperature measurement, plus interchangeability of all component parts, interchangeability of scale ranges, ready accessibility of all parts for individual checking and many other features. Wheelco UNIVERSAL Controllers include Capacitrols, Potentio-trols, Limitrols and Resistance Therm-otrols.

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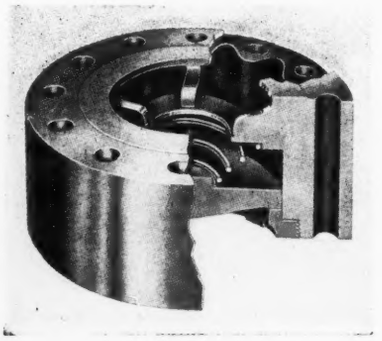
in., inclusive. Both valve disk and seat, only two parts subject to wear, are easily removable and renewable, and the valve can be reseated without special



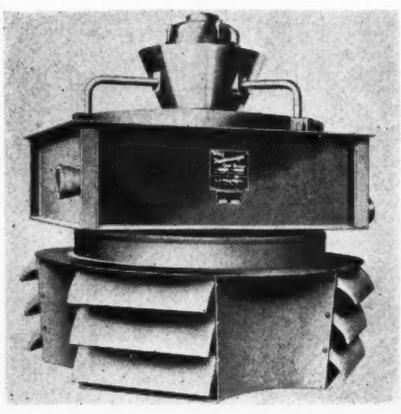
tools. Spring ring is now built as an integral part of body. *The Williams Gauge Co, 2055 Pennsylvania Ave, Pittsburgh, Pa.*

Spray Nozzle

ALFCO-SPRAY NOZZLE has been designed to meet the demands for a variable, all-spray nozzle, without a straight stream. From the shutoff position a slight turn of the tip immediately gives a 40-deg cone spray. Further slight rotation produces increasing cones up to full curtain of 150 deg, with reversal back to shut-off without intervening straight stream. Unit said to be favored by utilities as it prevents any possibility of a solid water stream being applied by mistake on large electric circuits. The varying cones are also excellent for extinguishing heavy oil fires, and for general cooling purposes. In 40-deg. spray position capacity is about 95 gpm and 135 gpm at 50-and 100-lb inlet water pressures, respectively. Full curtain capacity at these pressures is approximately 170 gpm and 215 gpm. *American-LaFrance-Foamite Corp, Elmira, N. Y.*

Revolving Unit Heaters

COMPANY ANNOUNCES ADDITION to the line of revolving unit heaters, with a new variable discharge heater. Provision for adjusting the amount of



How a Transparent Duplicate HELPED MOVE a Factory...

A LEADING MANUFACTURER wanted to move into a more desirable building—but hesitated when he saw estimates of the time which would elapse before he could begin production.

Ozalid then showed how five hundred hours could be saved in drafting time alone! First, instead of making multiple drawings of the master floor plans—Ozalid transparent duplicates were quickly made. The draftsman then added—direct to the duplicates—the plans for machinery layout, ventilating and heating, transmission and beltings, electrical and plumbing connections, etc. These duplicates were used to produce the desired number of work prints. Thus, in changing over . . . time and labor were saved.

Today, many manufacturers are reorganizing factories and assembly lines . . . making frequent changes in product design. And the Ozalid Process is giving them a "head start" in vital war production. An Ozalid whiteprint machine turns out standard and transparent prints in two quick steps—Exposure and Dry Development . . . without the wasteful tie-ups which are a part of "wet" developing methods. And Ozalid's wide variety of sensitized materials allow you to: cut drafting time . . . speed the making of corrections . . . turn out whiteprints which will have the most "back bone" in the busy shop or sun-baked field.

Write for new catalog. See how the Ozalid Process can help you!

BASIC FACTS ABOUT PRINT MAKING YOU SHOULD KNOW
OZALID TRANSPARENT FOILS ARE USED TO MAKE COMPOSITE PRINTS—The extreme transparency of Ozalid foil allows using multiple layers at one time to make a composite print. Thus, if you have separate details—each on a different foil—which you want brought together in one print, merely place the foils, one on the other, and feed with a piece of Ozalid sensitized material into the white-print machine.
Consequently, you can make prints which will show such details as plumbing and heating, power and pipe lines, etc., either separately or combined.
Foil copies of original drawings are made the same as standard whiteprints.
SPECIFY Ozalid WHITEPRINTS

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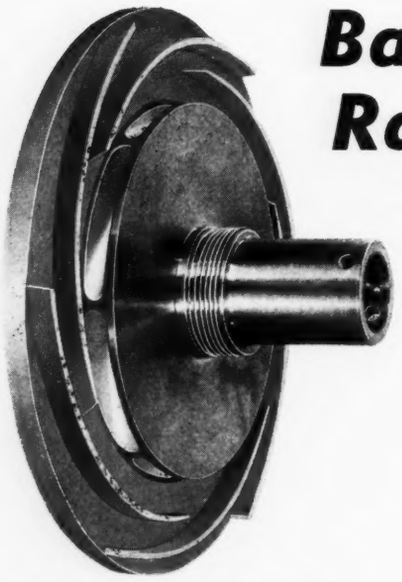
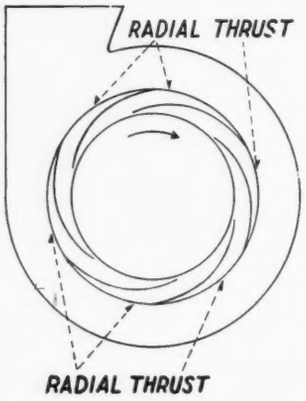


Balanced Radial Thrust



THE

COFFIN-Steam Turbine CENTRIFUGAL PUMP

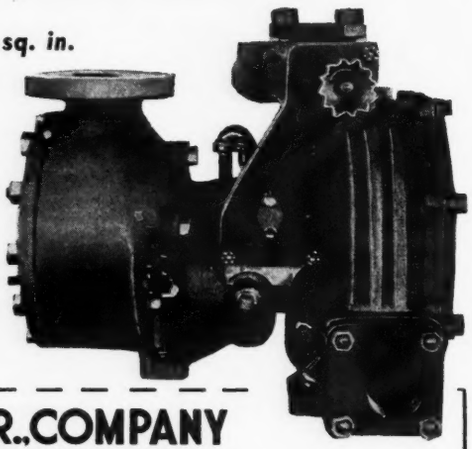
Unlike the volute type, insures a uniform, balanced radial load on the impeller.

The diffuser vane construction eliminates the unequal, pulsating load which tends to deflect the shaft, particularly at reduced capacities.

The wide selection of diffuser and impeller combinations, which this design affords to suit each operating condition, insures greater maximum efficiency within commercial limitations.

Efficiency and economy alike point to the Coffin Steam Turbine Centrifugal Pump as the selection for your next installation.

PRESSURES TO—750 Lbs. per sq. in.
DELIVERIES TO—500 G.P.M.



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THE J. S. COFFIN, JR., COMPANY
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Please Send Descriptive Bulletin I-21

NAME

COMPANY

ADDRESS

P.W.

heated air discharged from any side of the heater is incorporated in discharge outlet, thus making possible the heating of a long, narrow room or building, with one revolving heater, the air-streams being reduced and extended as the discharge outlets cover the sides and the ends, respectively. Discharge from the multiple outlets is said to be particularly effective in buildings or rooms with low ceilings. Additional number of outlets break up the discharge into slower, but more closely spaced streams of heated air which circulate around obstacles. *L J Wing Mfg. Co, 160 W 14th St, New York, N. Y.*

Stirrup Pump Barrel

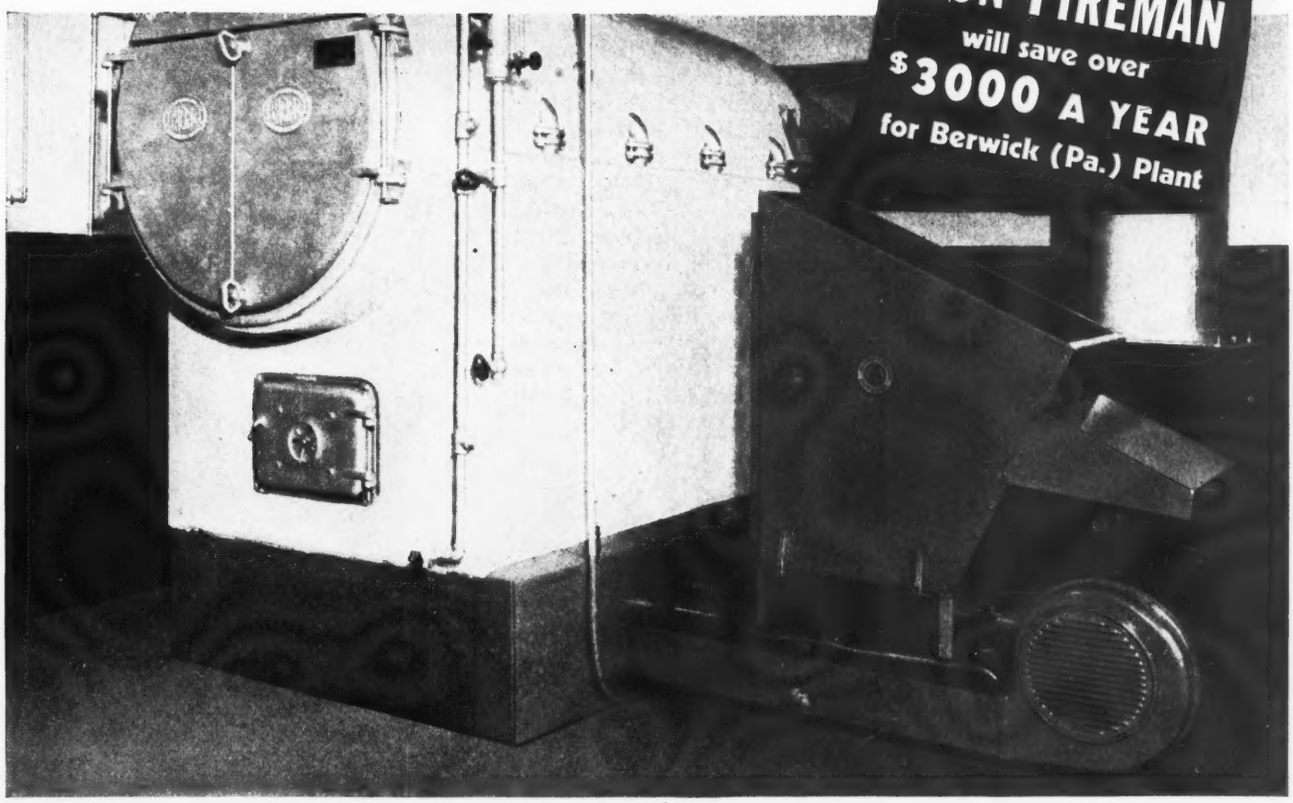
BARREL PUMP EXTINGUISHER consists of a 20-gal barrel mounted on wooden wheels for rolling to place of use. Two handles are attached for carrying from floor to floor if necessary. Barrel top is fitted with a hinged cover so 20-gal of water can be poured into the barrel. Stirrup pump fits into the barrel top.

with a hose and nozzle that will allow for spray adjustment. An axe is attached to the side of the barrel for emergency use. Entire assembly is painted bright yellow for maximum visibility in the dark. *Specialties Mfg Co Inc, 35 Farrand St, Bloomfield, N. J.*

Chain-Type Conveyor

NEW CHAIN-TYPE CONVEYOR consists of steel-tubular track with a continuous chain made up of vertical and horizontal wheel units. Vertical wheels are connected by an axle through side plates of unit frame; horizontal unit is made of wheel and link, wheel bearing on inside track when rolling around a hori-

Pennsylvania Plant Changes to Coal



Berwick Weaving, Inc., Switches to IRON FIREMAN Stoker Fired Coal

★ "The changeover from a restricted fuel to automatic coal will reduce fuel bills at Berwick Weaving, Inc., $3300 annually," says Charles C. Hertel, Jr., president. "We estimate a 1942 coal bill for heating and process steam of $1144, whereas previous fuel bills amounted to $4459 for the same operations.

Charles C. Hertel, Jr.

"Iron Fireman firing is maintaining a *uniform* temperature—between 86° and 88° Fahrenheit and a relative humidity of between 63% and 65%, 24 hours a day, 7 days a week—necessary to the type of cloth manufactured at Berwick. Besides it provides steam 10 to 16 hours a day, 5 days a week, for a process machine which consumes 600 lbs. of steam per hour."

Iron Fireman Poweram at Berwick

The clean-cut appearance of this Poweram installation has set a standard of cleanliness throughout the whole Berwick Weaving plant. The side installation keeps the boiler front clear. The Iron Fireman Poweram stoker, designed for heavy, continuous loads, combines *worm feed* with *ram distribution* of coal. The worm conveys the coal to the retort in a loose, aerated condition; reciprocating blocks distribute it evenly and prevent packing.

Today, in tens of thousands of boiler rooms, Iron Fireman coal stokers, burning an *unrestricted* fuel, are helping industries meet war needs by stepping up steam output 10% to 35%.

Easy to Change to Iron Fireman Coal Firing

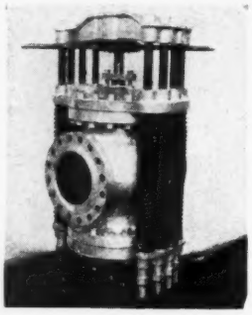
If you are faced with fuel changes or increased steam loads, find out how quickly Iron Fireman equipment can be installed. Iron Fireman engineers are ready to make an immediate survey of your steam plant, no obligation. For free survey or complete catalog on the Iron Fireman Poweram, write or wire the Iron Fireman Manufacturing Co., 3309 W. 106th St., Cleveland, Ohio.

IRON FIREMAN AUTOMATIC COAL STOKERS

DAVIS RELIEF VALVES

ABOVE — No. 80 "Noiseless" semi-balanced Back Pressure Valve for exhaust lines.

USE the accompanying chart as a guide in determining the proper type of relief valve for every job. It lists valves suitable for every relief service, including valves designed for full pipe capacity at rated relief pressure with minimum accumulation. Hand testing levers may be incorporated on most designs. Manual control and stay-open features are available on atmospheric relief valves. Send data on your service conditions for complete recommendations on the proper valves for your plant. DAVIS REGULATOR CO., 2540 S. Washtenaw Ave., Chicago, Ill.



LEFT—No. 265 Turbine Bleeder Relief Valve with spring loading. Available in a full range of sizes for pressures from 5 to 200 lbs.

RIGHT—No. 110 Exhaust Relief Valve for condenser relief to atmosphere. Available in horizontal, vertical and angle patterns.

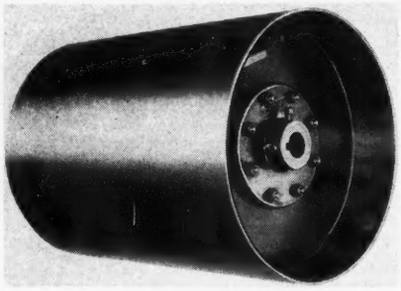
THE DAVIS LINE (Standard Items)		For Steam, Air and Gas *Also Water and Oil											For Steam									
Valve No.		13R	*14R	15R	*16R	*18R	*19R	49	*180R	*182R	260	*261	401	80	81	82	110 118	111 112	113	113B	116 117	118B	265
Service	Pressure Relief to Atmosphere												✓	✓	✓	✓				✓		✓	
	Pressure Relief into L. P. Lines		✓	✓	✓																		
	Vacuum Relief		✓	✓	✓	✓	✓																
	Pump By-Pass	✓							✓														
	Protection of Major Equipment										✓	✓					✓	✓	✓	✓	✓	✓	✓
Max. Relief Pressure		100	150	30	125	50	100	200	150	500	50	15	500	20	20	20	Atmos.	Atmos.	Atmos.	10	Atmos.	10	250
Single Seat		✓				✓	✓	✓			✓	✓					✓	✓	✓	✓	✓	✓	✓
Double Seat			✓	✓	✓			✓	✓	✓			✓	✓	✓	✓							
Diaphragm Actuated		✓	✓	✓	✓	✓	✓		✓														
Piston Actuated										✓													
Direct Disc Actuated											✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Auxiliary Pilot Control								✓					✓										
Spring Loaded		✓	✓				✓	✓	✓	✓	✓	✓	✓										✓
Weight Loaded				✓	✓	✓								✓	✓	✓				✓		✓	
Range of Sizes, Scr'd.		⅜" 2"	½" 4"	½" 4"	½" 4"	½" 4"	½" 4"	½" 4"	½" 4"	½" 4"	2" 4"	2" 4"	½" 4"	2" 6"	2" 6"	2" 6"							
Range of Sizes, Fl'g'd.			1½" 14"	1½" 14"	1½" 14"	1½" 14"	1½" 14"	1½" 14"	1½" 4"	1½" 4"	2" 8"	2" 8"	1½" 14"	2" 24"	2" 24"	2" 24"	6" 30"	6" 48"	6" 30"	6" 30"	6" 30"	6" 30"	4" 20"
Material Specifications — Body	Bronze	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓										
	Semi-Steel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Steel	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓										✓
Trim	Bronze	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nickel Iron		✓		✓			✓					✓										
	Monel	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓										✓
	Stainless Steel	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓										✓

DAVIS REGULATOR COMPANY

zontal curve. Vertical units carry the load, ride bottom of track on horizontal runs, roll under track top on vertical curves, turning upward or straightening out from downward to horizontal movement. Two sets of wheels keep the chain assembly in the centerline of the track. Conveyor will handle 65 lb per ft of length in a single suspension, 125 lb with double suspension. *Richards-Wilcox Mfg Co, Aurora, Ill.*

Solid Conveyor Pulley

TYPE "N" SOLID CONVEYOR PULLEY is made with tight ends and is easily kept clean, according to maker. No spilled materials or dust or water can accumulate inside pulley. Pulley is of rolled steel, light in weight, and practically



unbreakable. Removable, interchangeable hubs assure quick, easy mounting. Pulley diameters are from 6 to 36 in. *American Pulley Co, 4200 Wissahickon Ave, Philadelphia, Pa.*

Butterfly Valve

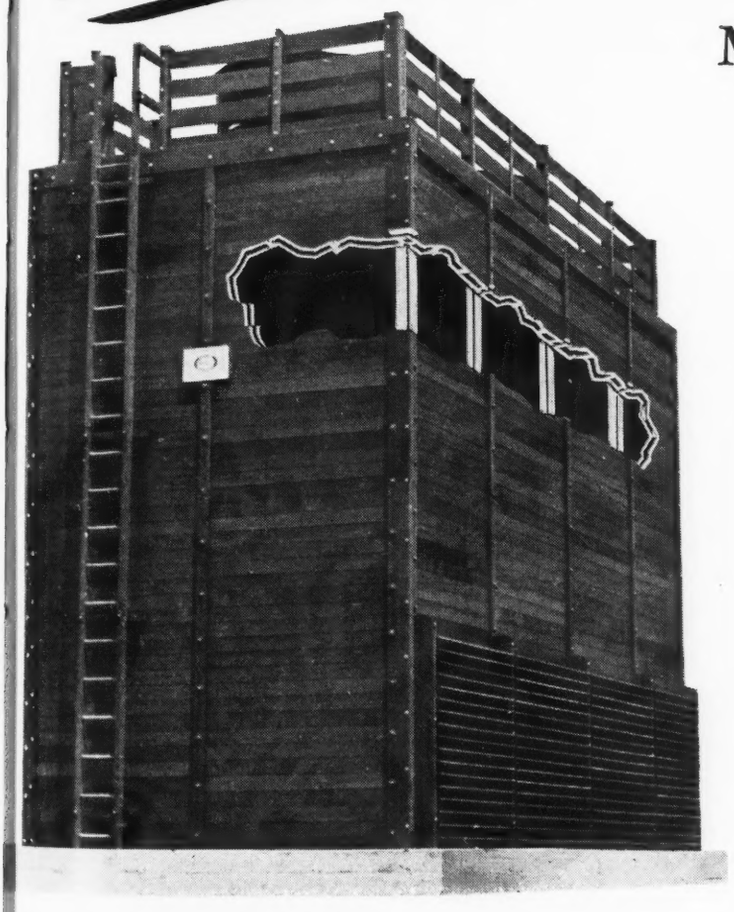
THREE-WAY BUTTERFLY VALVE is for mixing and quick interchange service and adapted to fully automatic control by means of an air-diaphragm motor or hydraulic cylinder. Valve is of cast steel or cast iron for pressures up to 600 psi. When desirable, special metals for resistance against heat, abrasion and corrosion can be substituted. Special feature is self-cleaning, double-beveled, streamlined vane. This seats wedge-tight against the body of the valve, thus producing a tight shutoff as well as positive control of volume and pressure. *R-S Products Corp, Wayne Junction, Philadelphia, Pa.*

Hand Operated Stokers

COMPANY ANNOUNCES complete line of its "self-cleaning" hand-operated stokers for changing over boiler installations formerly dependent on other fuels threatened with scarcity at the present time. In the American "self-cleaning" stoker the coil is placed on the front of the stoker, and is then distributed mechanically. One lever does it, advancing the fuel toward the dump plate

One of a series of advertisements, each devoted to a Marley cooling tower feature that has become an accepted standard of the best practice in modern mechanical draft water cooling.

Another of MARLEY'S PLUS Features



MARLEY **Double-Wall Casing**—*two* walls of shiplap Redwood with the air space between them unrestricted from top to bottom of the tower—was originated by Marley for Mechanical-Draft Cooling Towers more than a dozen years ago.

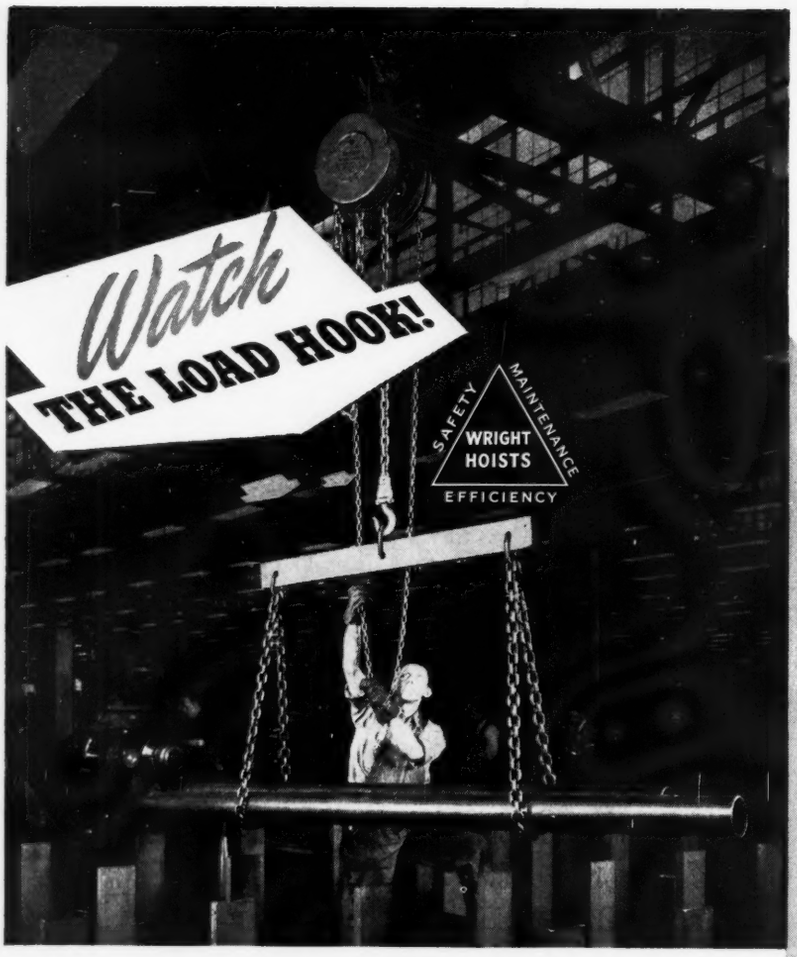
Vertical studs on close centers truss the two walls together so that the casing becomes a continuous beam spanning between frame columns. The entire casing is secured to the framework by through-bolting which clamps the casing between the frame columns on the inside and heavy trim strips on the outside. This manner of bolting, plus building and applying the casing in prefabricated sections, permits necessary expansion and contraction without stressing either the casing or the framework.

Since any water seepage can only penetrate the inner wall and run down the air-space side, the outer wall remains dry, tight and free of seepage stains, preserving lasting good appearance. The smooth surface enhances the tower's neat looks and facilitates painting if desired.

This advantageous type of casing is just one of the many exclusive mechanical and structural features which account for so many *more* cooling towers bearing the Marley name.

MARLEY COOLING TOWERS

Every MARLEY TOWER *is individually engineered by* THE MARLEY CO., INC. — KANSAS CITY, KANSAS



★ In one of their recent bulletins on hoists, the National Safety Council says:

> ❝ *Hooks which have become bent on account of overloading should not be straightened and put back in service, but a new hook should be provided. When a hook is once bent the stress in the metal tends to weaken it so that afterward its strength is a matter of doubt and cannot be depended upon.* ❞

That's good advice. With the lives of American boys utterly dependent upon our industrial production, this is no time to take chances which may cause lost time accidents to men or machines, or both.

Watch the Hooks. Wright load hooks are drop-forged from special steel which, when subjected to excessive overloading, give visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

Don't Abuse Your Hoist. Now that we are all faced with restrictions and shortages proper maintenance is of paramount importance. While every **WRIGHT HOIST** is built with load-carrying factors considerably in excess of their rated capacities, like many other well-made pieces of mechanical equipment built for specific duty, they should not be overloaded. Overloading is dangerous—to men, materials, machinery and steady production. Remember—abuse to machinery today is akin to sabotage. Conserve steel and maintain production schedules by careful use, regular inspection and proper lubrication.

WRIGHT MANUFACTURING DIVISION
YORK, PA. CHICAGO SAN FRANCISCO NEW YORK

In Business for Your Safety

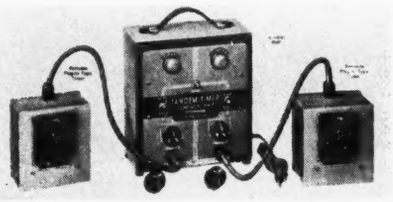
ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

where the ashes can be dumped as they accumulate. Stokers are designed for operation with natural draft and require no steam or electric power. Sizes range from 100 to 4000 lb of coal per hr. *American Coal Burner Co, Chicago, Ill.*

Timing Device

TANDEM TIMER PERMITS practically any timing sequence desired. Unit is essentially a control unit with two individual and variable plug-in timing elements. With the timing elements adjusted to their correct respective time intervals, each cycle of operation will



follow the other continuously in regular sequence. When timer dials are once set at the time interval desired, further adjustments are unnecessary until a new sequence is required. Automatic reset features make a continuous as well as a single-cycle operation possible. Plugging in of different timing elements is accomplished in seconds. *Industrial Timer Corp, 113 Edison Place, Newark, N. J.*

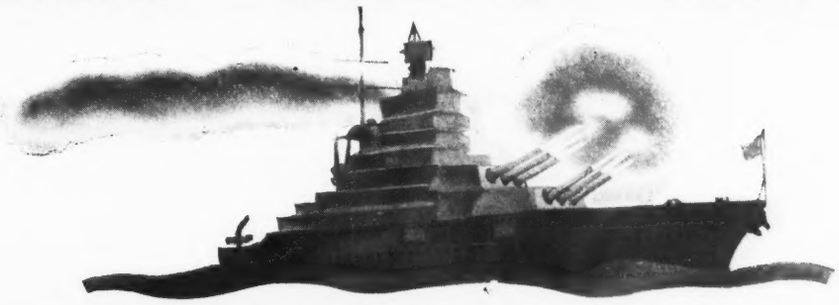
MX Granules

MX GRANULES are for extinguishing magnesium fires. Manufacturer claims that control of magnesium fires with MX granules is simple and effective. Tests are said to show that, when spread over the fire, these granules soften and seal the burning magnesium with an air-tight blanket, cutting off oxygen and quickly extinguishing fire. Same principle and methods apply also and with equal effectiveness, according to the maker, to extinguishing magnesium incendiary bombs. An added advantage claimed is large percentage of metal recovered after fire is extinguished. Tests are said to show that when 3 lb of magnesium alloy scrap were ignited MX granules applied to the burning mass, fire had been extinguished in five minutes and 2 lb, 5 oz of metal recovered. *Philip Carey Mfg Co, Lockland, Ohio.*

Evaporative Condenser

EVS AQUAMISERS are made in a complete range of sizes from 5 to 100 tons normal refrigeration capacity. These new units are used as condensers for Freon refrigeration compressors, and also as process liquid coolers. Typical applications include: jacket-water cool-

New Armor-Plate...and Back on Duty



APEXIOR ON OLD BOILER METAL GUARDS IT FOR THE DURATION

American vessels, badly damaged at Pearl Harbor and in the South Seas — "destroyed", according to the enemy — are already back in service, repaired, rearmored, fit for duty.

And plenty of steam boiler equipment, thought ready for the bone-yard, has been cleaned up, given APEXIOR'S armor-plate protection against wear and corrosion, and recalled to active service.

Make sure *now* that every tube and drum in your plant will be on duty for the duration . . . you *can't get* replacements. If your boiler, when cleaned to bare metal, comes through the required hydrostatic test, APEXIORIZE, and with reasonable care it is good for years.

APEXIOR — Impenetrable Armor-Plate against Corrosion and Wear

You put it on with a brush — hand or power-rotary. The chemically inert, tough protective coating fills and seals all joints, pores and surfaces, rendering boiler metal immune to corrosive penetration, resisting the erosion that would wear bare metal down.

Water scale, if any, adheres loosely, for there can be no direct, chemical bond. Off it comes by wire-brushing.

In 2 or 3 or more years, APEXIOR will wear thin. Simple, single-coat renewal then restores its original protection.

★ ★ ★ ★ ★ ★ ★ ★

APEXIOR Guarantees Good Metal Condition — no other protection offers the same assurance and security

For years, wise engineers have used APEXIOR NUMBER 1 as insurance of efficiency and good boiler housekeeping — supplementing proper feedwater treatment.

Now, this precaution becomes essential.

Recommended by all U. S. & Canadian boiler insurance companies.

Write for Bulletin 1290

APEXIOR
REG U.S. PAT. OFF.

THE DAMPNEY COMPANY OF AMERICA

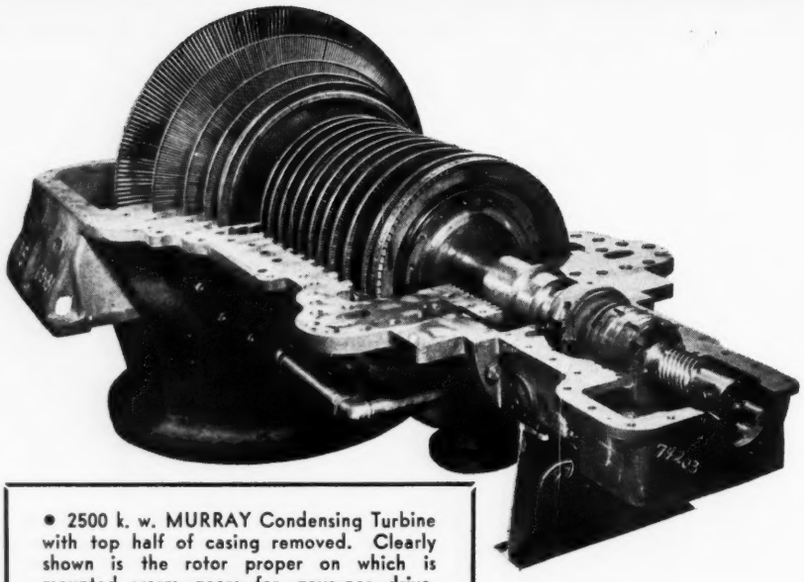
PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

HYDE PARK · BOSTON · MASSACHUSETTS

Atlanta Chicago New York Detroit Philadelphia

Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manila, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

MURRAY
has cooperated
WITH INDUSTRY FOR OVER 70 YEARS ON STEAM POWER PROBLEMS



• 2500 k. w. MURRAY Condensing Turbine with top half of casing removed. Clearly shown is the rotor proper on which is mounted worm gears for governor drive, Kingsbury thrust bearing, self-aligning bearings. Note carefully designed bolting arrangement for casing and also flexible steam end support as well as exhaust end support. 48" diameter exhaust flange and 48" pitch diameter low pressure wheel is shown.

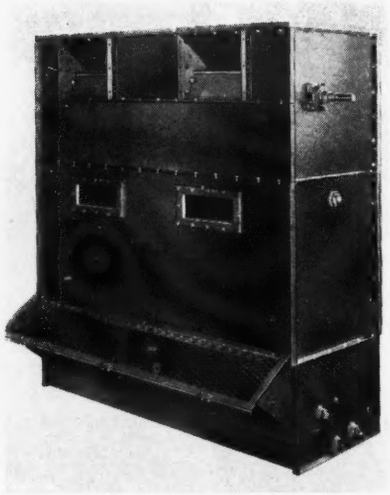
The success of MURRAY Turbines is due to excellence of design, careful selection of materials, and accuracy of workmanship for which this organization has been known for so many years. These turbines continue to be specified by holders of high priorities and our large facilities are busy cooperating in the national victory effort. Those who are not in the high priority purchase group will find it advisable to have full information on MURRAY Turbines so that future needs can be planned. Write for bulletins.

BOILERS TURBINES ENGINES

MURRAY IRON WORKS COMPANY

INCORPORATED 1870

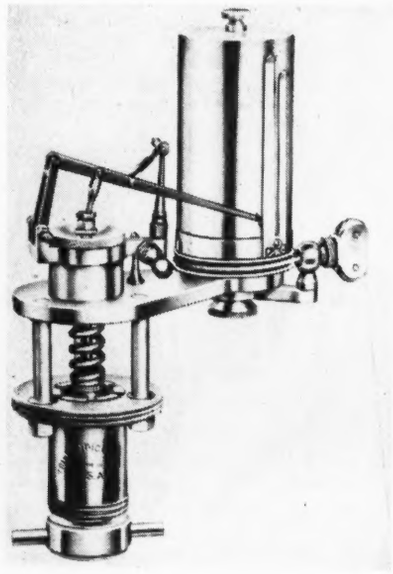
BURLINGTON IOWA

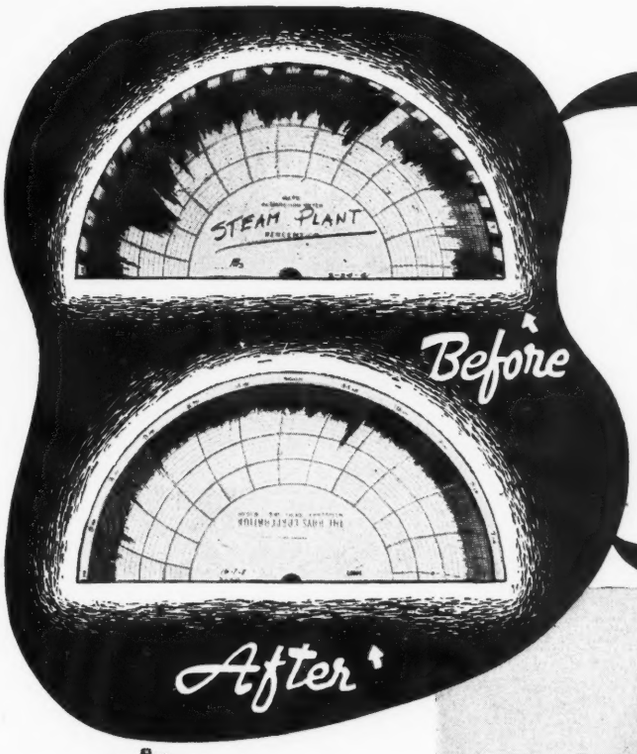


ing for diesel engines and air compressors; quenching oil cooling, and anode cooling. Temperatures to which liquid can be cooled by this means depend upon wet bulb temperature of the air, kind of liquid, and its entering temperature. The aquamisers consist of three major sections: fan, condenser and sump. The casing is made of heavy, galvanized sheet steel and all parts are adequately protected against corrosion and severe operating conditions. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Marine-Engine Indicator

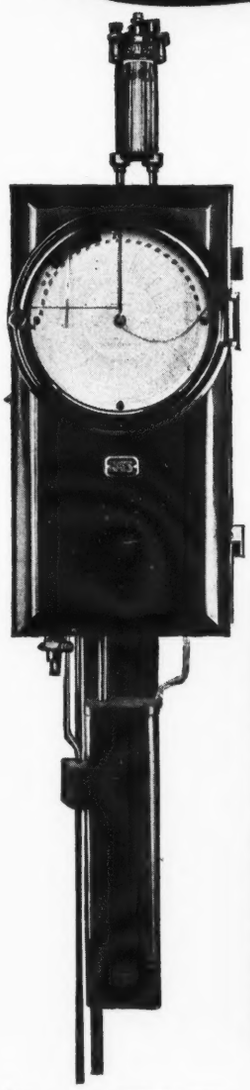
TRILL INDICATOR embodies design features that assure continuously accurate indicating of the Liberty ships' reciprocating steam engines under today's operating conditions. Indicator spring is located outside and can be easily attached and replaced. Piston and sleeve are also accessible. Piston sleeve is separate from indicator body and is surrounded by well-drained steam space. Use of this indicator provides operator

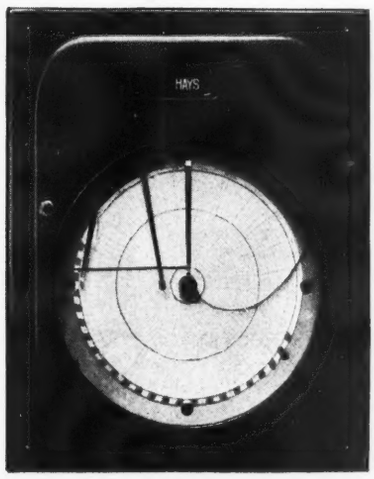




HOW HAYS COMBUSTION METER *Improves Boiler Operation*

THE two segments of charts shown above, taken from a Hays Combustion Meter installed in a north west paper mill tell a graphic and convincing story. Upper chart shows the low and erratic CO_2 the first day of operation, typical of the wasteful method of firing before installation of meter. Lower chart shows results exactly one week later, after the meter had taught the operators how to fire the boiler properly—fuel saved, smoke eliminated, more heat secured, steam pressure more constant.





Send FOR THIS HANDSOME NEW BOOK

It contains complete information on CO_2 —its significance and measurement. It's FREE.

The HAYS CORPORATION
SINCE 1901 COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

WELDOLETS·
TRADE MARKS · REG. U.S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

How to cut the cost of right-angle branch pipe outlets

THE most costly part of any piping installation is the labor and materials required to make branch pipe outlets. Bonney Weldolets, Thredolets and Socket-End WeldOlets will keep that cost to a minimum.

Using these fittings, installing them either by electric-arc or oxy-acetylene welding will reduce the cost of right-angle branch pipe outlets from 10 to 35% when compared to the cost of making similar outlets with threaded tees or pipe-to-pipe intersection welds.

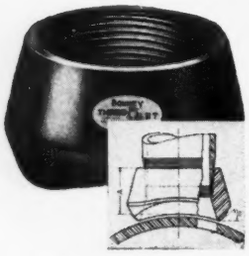
Bonney WeldOlets, ThredOlets and Socket-End WeldOlets provide other advantages impossible to obtain by using other methods to make similar types of outlets. Because they are installed by welding, they eliminate all cutting, threading or fitting of the main pipe. Because of their patented design they provide an outlet of full pipe strength that is absolutely leakproof and which, because of its funnel-shaped intake aperture, reduces friction and turbulence to a minimum.

WeldOlets, ThredOlets and Socket-End WeldOlets eliminate the necessity for templets and preliminary layout of the main and branch lines. The fitting itself is used as a templet.

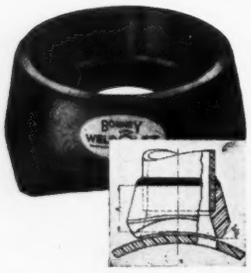
Standard stock fittings (outlets from ¼" to 12") in size-to-size and reducing sizes are drop forged steel. For special applications, or where unusual conditions exist, they can be supplied in Toncan Iron, wrought iron, brass, Monel, Everdur, etc. and in sizes up to 24" x 24". WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for every type of piping installation and for all commonly used pressures and temperatures.

Your local distributor will be glad to tell you the complete story about savings which can be affected—or, write for Bulletin WT31—TODAY.

WELDOLET

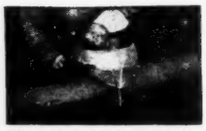


THREDOLET

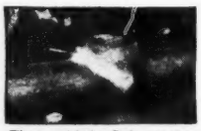


Socket-End WELDOLET

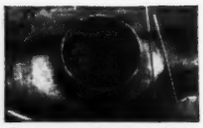
EASILY INSTALLED



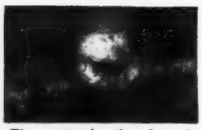
Mark center lines and tack the fitting into place.



Then weld the fitting to the main pipe.



Remove the button, which will also permit inspection of the inside of joint.



Then attach the branch pipe.

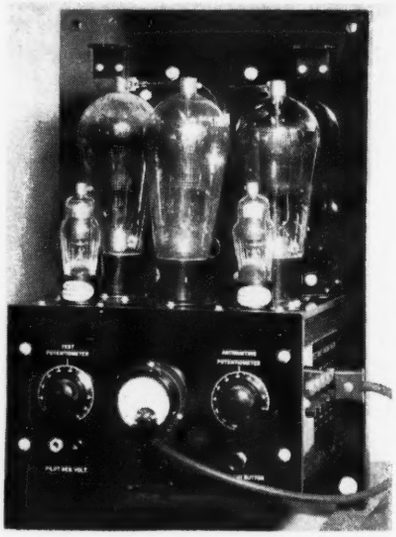
Bulletin WT31—just off the press—a 16 page catalog covering every feature of these fittings in complete detail and showing many of the various types of installations on which they have been made.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

with engine-performance diagram which acts as guide to necessary adjustments or repairs. This prevents breakdowns, saves time and money and keeps engine running for longest possible time at highest degree of efficiency. *Trill Indicator Co, Pittsburgh, Pa.*

Voltage Regulator

DT-5 ELECTRONIC VOLTAGE REGULATOR is a sensitive electronic device which regulates output voltage of ac and dc generators, providing output voltage is more than 46 volts. Unit operates from a 3-phase ac power supply and acts as a grid-controlled rectifier to supply dc



field current to the generator, or the exciter of the generator being regulated. The regulator is built on a Micarta panel 1 in. thick and is designed for master panel mounting. No inclosing cabinet is provided, but tubes are protected by a screen cover. An anti-hunt circuit is built into the regulator, preventing the regulator from overshooting when close regulation is required. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Secondary Protector

THYRITE SECOND PROTECTOR is for use on current transformers to provide protection against high open-secondary-circuit voltages. Consists of a Thyrite disk connected across transformer secondary terminals, together with a thermostatically operated short-circuiting switch. In operation, when external secondary circuit becomes accidentally opened, secondary current will pass through the Thyrite disk. When the disk temperature reaches approximately 100 C. the thermostat operates switch to short-circuit Thyrite and prevent damage that would be caused by overheating. When the temperature of the disk drops to

Ships, planes, guns, tanks start in a coal mine

This is a war of machines and armaments, and vast quantities of power are required to build them. Despite all the other forms of energy, 60% of all horse-power required by American industry comes from coal.

Our whole civilization is based on coal, and our whole *defense* of that civilization is based on it. Coal provides heat. Gasoline can be made from coal. Rubber is about to be made from it. Many vitamins are coming from coal's derivatives.

Coke made from coal is indispensable to steel. Railroads consume one out of every five tons mined. Dozens of vital industries look to it for one or more of the 150,000 chemical compounds already identified through coal carbonization.

Koppers builds most of the coke ovens which carbonize millions of tons of coal . . . is an important producer of chemicals for war . . . of anti-aircraft gun mounts, airplane catapults . . . airplane, submarine, diesel and automobile piston rings . . . Fast's Couplings for power transmission . . . pressure-creosoted timber, ties and piling . . . and dozens of other products. Koppers Company, Pittsburgh, Pa.

Buy United States
War Bonds and Stamps

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

Workers in our Bartlett Hayward Division are now privileged to wear the Navy "E" emblem

THE COMPLETE BOILER TUBE SERVICE

● For more than 23 years we have been fabricating tubes for all types and sizes of boilers. So, whether it's an order for one tube, a dozen, or a carload, we know what you want *first*—you want your tubes *right*. We know, too, what you want *next*—you want them *now*.

We have the experience and the craftsmanship for accuracy—the capacity and the facilities for speed. Just specify the type of tube you prefer...along with specifications as to type of boiler . . . tell us you want them in a hurry...leave the rest to us.

BOILER TUBE COMPANY OF AMERICA

MAIN OFFICE & WORKS
3126 PREBLE AVE., PITTSBURGH, PA.

●

PITTSBURGH • NEW YORK
PHILADELPHIA • CHICAGO

Home to Roost

HOME TO ROOST, these eagles of the fleet return from their exploits of daring. In a voice a billion horsepower strong, the story they tell of American industrial might is ringing in the ears of Axis powers from Honshu to Hamburg.

That such an intricate mechanism as the engines that power these war eagles can be mass-produced is a tribute to the mechanical genius of American industry.

To transmit the thousands of horsepower that modern aircraft engines develop, gears must be finished to an accuracy that only a few months ago was considered a laboratory ideal. Yet today, thanks to new manufacturing techniques, these gears are rolling off production lines at Foote Bros. plant in ever increasing quantities. Such mass production promises a rapid realization of America's dominance of the air.

Engineering lessons learned today, give promise of speed reducers and gears that assure better machines—quieter machines tomorrow—produced by Foote Bros. for an industrial America at peace instead of an armed America at war.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

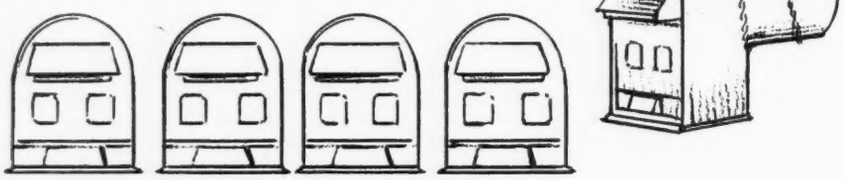
FOOTE BROS.

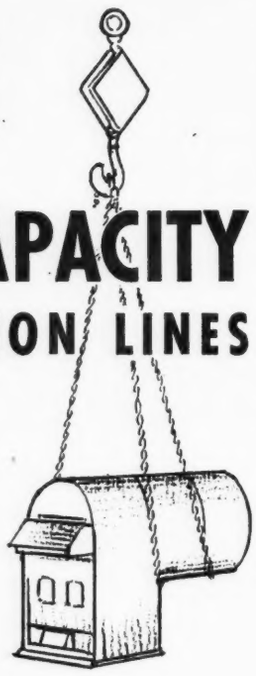
SPEED REDUCERS • GEARS • SPECIAL ASSEMBLIES

SWING

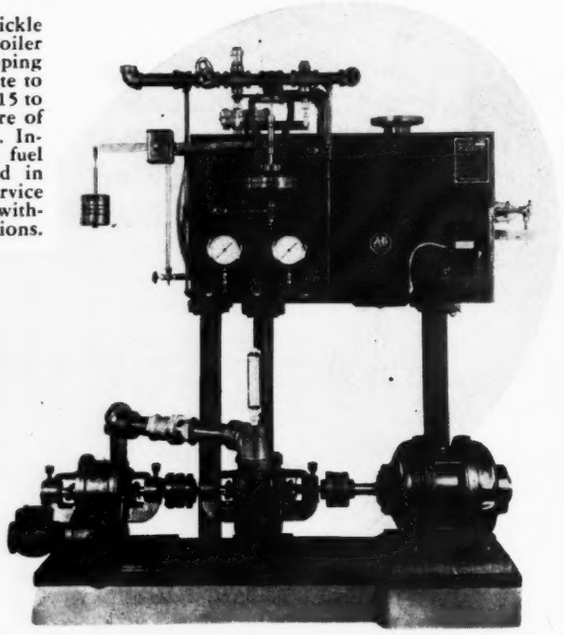
EXTRA BOILER CAPACITY INTO YOUR PRODUCTION LINES

WITHOUT AN EXTRA BOILER





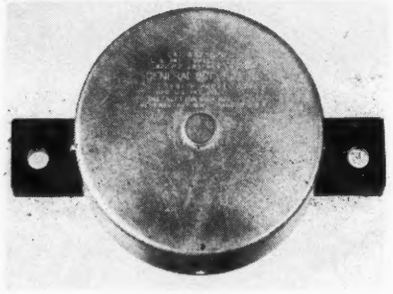
● Electric pumping unit of Stickle Differential Drainage and Boiler Return System—a closed pumping system that returns condensate to boilers at a temperature only 15 to 20 degrees below temperature of steam at operating pressure. Increased boiler capacity and fuel savings clearly demonstrated in many installations now in service one to 10 years. Installation without interrupting plant operations.



SAVE
One car of fuel out of 5 now used

● In many types of industry using steam for cooking, drying and other processing work, Stickle Differential Drainage and Boiler Return Systems are increasing boiler capacity 20 per cent as an average—*adding the capacity of an extra boiler for each four in use*—and saving a like proportion of fuel. Besides they are increasing operating efficiency of production units and reducing cost of maintenance for boilers, steam lines, valves and traps. Guaranteed minimum advantages the system will obtain in your plant will be furnished without obligation. Ask for complete information.

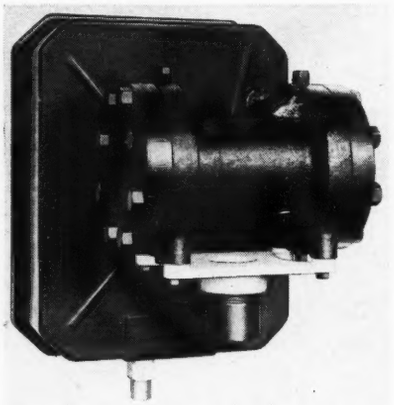
STICKLE
STEAM SPECIALTIES COMPANY
2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA



approximately 80 C. switch opens. This operation is repeated until normal conditions are restored to the secondary circuit, at which time the switch will remain open. *General Electric Co, Schenectady, N. Y.*

Manometer

ABSENCE OF MERCURY or other liquid from this latest development of the company removes possibility, according to the maker, of product contamination and hazard of mercury being blown because of line surges or carelessness. Further advantages are that sealing liquids are rarely required and vital mercury is released for the war effort. New torque assembly replaces stuffing box, giving a completely closed system



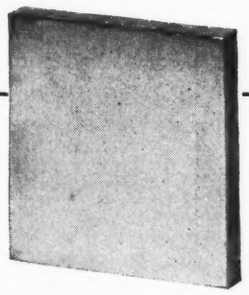
designed to eliminate friction and lubrication. Metal bellows respond to pressure variations and insure faster response under ordinary circumstances, with immediate reaction to sudden changes in flow. Sturdy bellows are built to withstand high over-range without damage. Under steady flow conditions manometer is accurate within 1% of scale range. Available for all indicating and recording meters and controllers, and is supplied for standard ranges between 20 and 500 in. of water. *Taylor Instrument Co's, Rochester, N. Y.*

Loose-Pulley Oiler

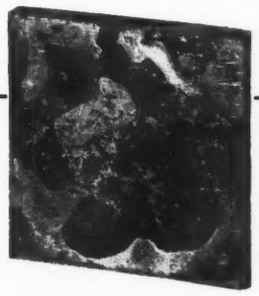
LOOSE PULLEY OILER is for use on loose pulleys, idler pulleys, clutches, eccentrics, and similar rotating machine parts. Designed to deliver a constant, positive

RUST INHIBITIVE INSULATION!

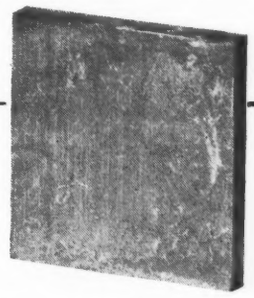
Camera proof that Eagle Super "66" Plastic Insulation actually prevents corrosion



Flat polished steel plate—type used in making extensive laboratory tests to check rust-inhibitive properties of various kinds of plastic insulation.



Rusted, pitted surface of identical steel plate which was coated with ordinary plastic insulation and subjected to room temperatures for several weeks.



Identical steel plate after coated with Eagle Super "66" Plastic Insulation (applied wet) under same conditions. Note absence of rust or corrosion.

DOUBLE Protection Against Corrosion!

Eagle Super "66" does far more than effect sensational conservation of fuel in your plant.

Now this remarkable plastic insulation also checks rusting and corrosion of equipment. In addition to its natural non-corrosive properties, Eagle Super "66" is actually a rust inhibitor.

Of all plastic insulations tested in the laboratory, only Eagle Super "66" showed this desirable quality. All other insulations allowed corrosion of the surface to which they were applied.

Many other advantages: The basic insulating material in Eagle Super "66" is both chemically and physically stable. It does not deteriorate or disintegrate in use.

And its "springy-ball" structure assures positive heat control for temperatures up to 1800° F. . . . smooth-troweling application . . . maximum dry coverage (50-55 sq. ft. 1-in. thick per 100 lbs.).

Write today for new catalog sheets which give technical data on efficiency and application.

2 WAYS TO CONTRIBUTE TO NATIONAL DEFENSE

1. Conserve fuel.
The more efficient the insulation you apply to your equipment—the more fuel you can conserve—the more you can step up your plant efficiency. By applying insulation that does not lose its effectiveness or disintegrate, you can also operate with fewer shutdowns. Install only insulation that has proved its ability.

2. Protect Insulation.
Insulation that is worth installing is worth protecting. Eagle Insulseal is suggested for this job. This durable, fireproof coating protects all kinds of heat insulation from disintegration and loss of insulating value. Safeguards against air infiltration, moisture, water, fumes—against vibration and abrasion.

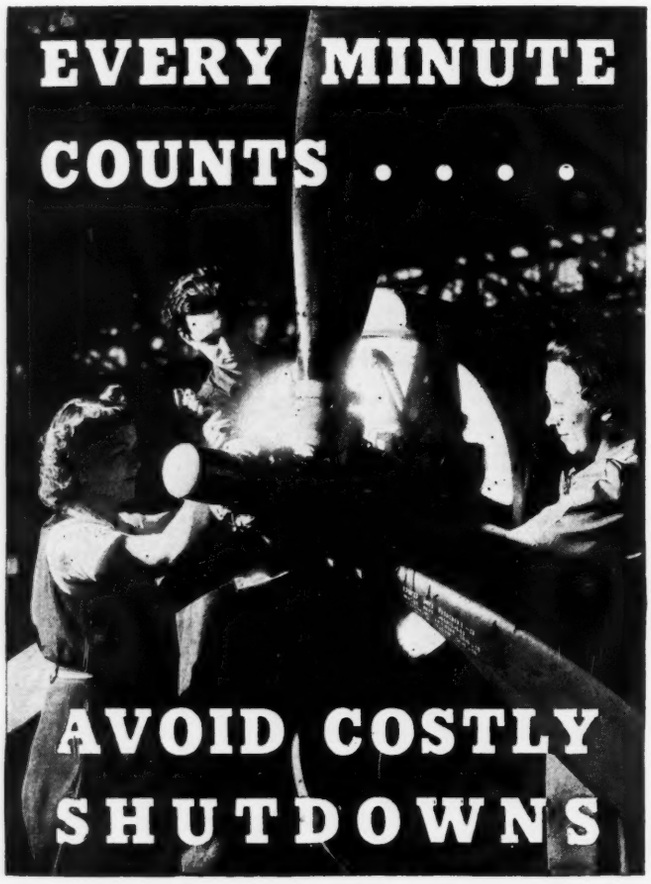
Eagle-Picher High Temperature Insulations

Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE EP PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

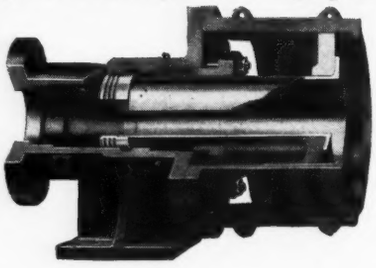
THE EAGLE-PICHER LEAD COMPANY · CINCINNATI, OHIO



Every minute counts at Socony-Vacuum Oil Co., Goodyear Tire & Rubber Co., Chrysler, Carnegie-Illinois Steel, DuPont and other war industries where ADSCO Piston-Ring Expansion Joints safeguard steam lines against costly shutdowns.

These are the only slip type joints that can be unpacked and repacked under full operating conditions, without interruption to service.

Piston rings in the internal guide hold the line pressure during unpacking and repacking operations. ADSCO Piston-Ring Expansion Joints are FULLY GUIDED by internal and external guides. Available in single or double joints for high pressure and high temperatures; flanged or beveled ends. Write for Bulletin 35-15PR.



ADSCO PISTON-RING EXPANSION JOINT
FOR STEAM, HOT WATER, OIL OR GAS LINES

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA N. Y.

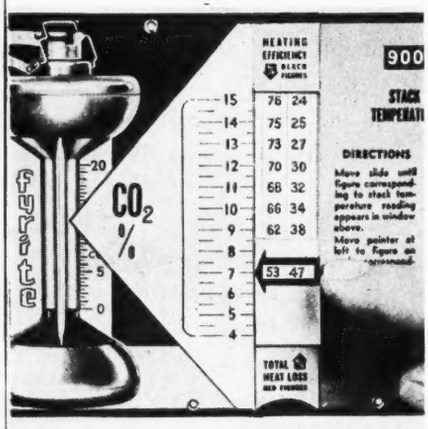
MAKING "UP-TO-DATE" STEAMLINE EQUIPMENT FOR OVER 60 YEARS

INSTALL ADSCO PISTON RING JOINTS
CAN BE PACKED UNDER PRESSURE

and regulated amount of filtered oil to shaft or bearing while pulley is in operation, and to prevent oil waste when pulley is idle. Reserve supply of oil is always visible. As the pulley rotates, and the lubricator with it, centrifugal force throws the oil out against top of the reservoir, and into two ports in the stem. These admit oil to the wick, which filters out all dirt and sediment, and conducts the oil directly to the face of the shaft. *Oil-Rite Corp, Milwaukee, Wis.*

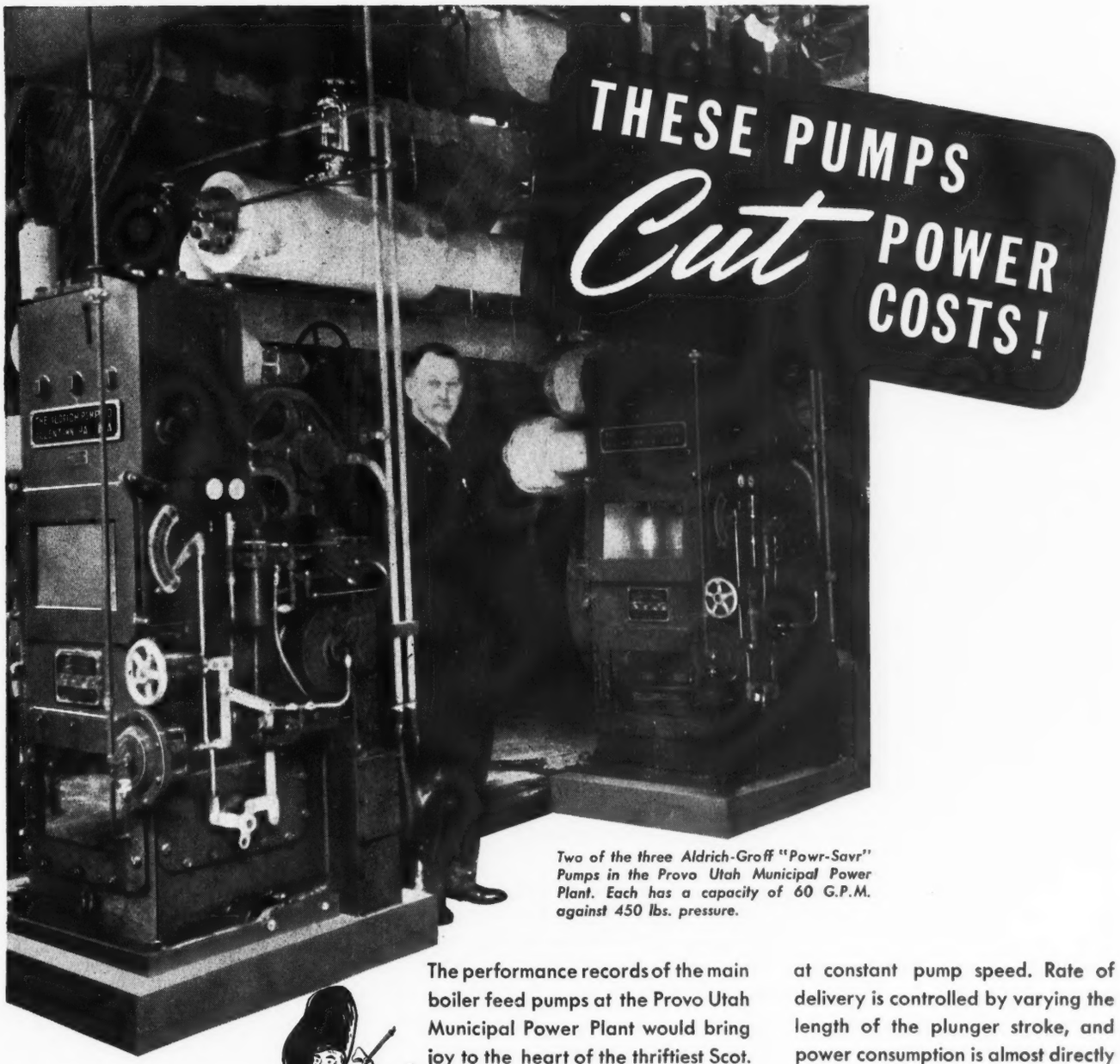
Fire Efficiency Finder

FIRE EFFICIENCY FINDER developed for use with Bacharach Fyrite CO_2 Orsat Analyzer. Unit is a calculator that converts CO_2 and stack temperature readings instantly into heat loss and heating efficiency percentages. Fire Efficiency



Finder together with Orsat supplies engineer with simplified quick way to determine furnace performance, since a complete CO_2 test can be made in 40 seconds with the Orsat, and the calculator converts the readings instantly into terms of degree of furnace efficiency. *Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh, Pa.*

THE ALDRICH-GROFF "POWR-SAVR" CONTROLLABLE CAPACITY PUMP



Two of the three Aldrich-Groff "Powr-Savr" Pumps in the Provo Utah Municipal Power Plant. Each has a capacity of 60 G.P.M. against 450 lbs. pressure.

The performance records of the main boiler feed pumps at the Provo Utah Municipal Power Plant would bring joy to the heart of the thriftiest Scot. These three Aldrich-Groff "Powr-Savr" Pumps have been "*the major contributing factor to the low station power consumption which runs consistently below 4.5% of the gross generation*".

Aldrich-Groff Pumps provide for automatic or remote manual control of delivery, from zero to full capacity, at constant pump speed. Rate of delivery is controlled by varying the length of the plunger stroke, and power consumption is almost directly proportional to pump delivery. These units combine the positive displacement and high efficiency of the plunger type pump with the flexibility and smoothness of the centrifugal pump. Their use is advantageous for main boiler feed in small and medium sized boiler power plants and de-superheating feed service in even the largest power installations.

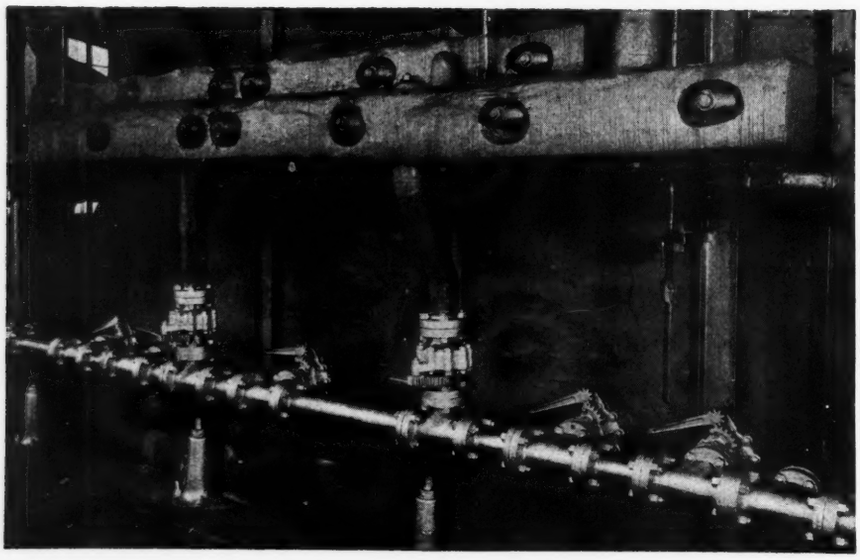
Write today for the Aldrich Bulletin #65 which gives full details, sizes and ratings of Aldrich-Groff "Powr-Savr" Pumps.

ALDRICH

FOR PUMPS AND HYDRAULIC EQUIPMENT

THE ALDRICH PUMP COMPANY

ALLENTOWN • PENNSYLVANIA



...in 70 degrees

QUICK, EASY, DEPENDABLE OPERATION

This completely distinctive and unique design has a drop-tight seal which assures leak-proof closure; and the disc has a rotating, self-grinding action on the seat at each movement, which *maintains* tightness indefinitely.

Enthusiastic users report that Everlasting Valves flow fluids faster, give better service, and last longer than other designs on process lines, emergency shut-offs, equipment outlets, boiler blow-off and similar services.

The many important and exclusive advantages of this design are described in bulletin which will be sent on request.

TYPICAL SERVICES WHERE EVERLASTING VALVES EXCEL . . .

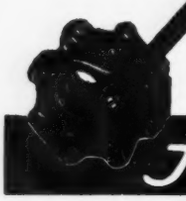
- **Outlets of storage and measuring tanks**
- **Throttles of hammers and hoists**
- **Presses for plastics**
- **Washers for laundries, cleaners and dyers**
- **Spray lines to rolls**
- **Blow-offs of condensers, economizers, vulcanizers, purifiers, compressed air tanks**
- **Suitable for acids, alkalies, caustics, cellulose, coal tar, emulsions, syrups, and other liquids; also gases and vapors**

Built in sizes from ¼-in. to 6-in., in cast iron, bronze and cast steel, and with a range of sizes for 250-lb., 350-lb., and 600-lb. pressures. Furnished with straight lever as shown in view of valve, or with rack and pinion as shown in photograph of installation.

EVERLASTING VALVE COMPANY

49 FISK STREET JERSEY CITY, N. J.

Everlasting Valves



for everlasting protection

New Power Construction

Construction to Come

California—Columbia Steel Co, Russ Bldg, San Francisco, plans constructing plant. Over $6,000,000. Defense Plant Corp will finance.

California—Aluminum Corp of America, 5151 Alcoa Ave, Vernon, making surveys constructing plant. $12,000,000. Defense Plant Corp will finance.

California—Joshua Henry Iron Wks, Sunnyvale, plans constructing plant. $4,000,000. Defense Plant Corp will finance.

California—Shell Chemical Co, 100 Bush St, San Francisco, plans constructing plant. $15,000,000. Reconstruction Finance Corp will finance.

Colorado—War Dept, 20 St and Constitution Ave N W, Wash., D. C., plans constructing plant. Over $3,000,000.

Illinois—Industrial company plans, by Schmidt, Garden & Erikson, 101 S Michigan Ave, constructing 1-story, mfg plant. Over $1,000,000. H J Maveety, 53 W Jackson Blvd, Chicago, structural engr.

Illinois—U S Eng, 520 Merchandise Mart, Chicago, plans constructing plant. Over $3,000,000.

Ind., Mishawaka—Indiana & Michigan Electric Co, 220 Colfax Ave, South Bend, plans by American Gas & Elec Service Corp, archt and engr, 30 Church St, New York, N. Y., constructing power plant addn, turbine room and boiler house, office and storage bldgs, $550,000.

Mass., Hudson—Town, Electric Light & Power Dept, Town Hall, receiving bids from invited list bidders constructing addn power plant. $40,000. A L Nelson, 31 St James Ave, Boston, engr.

Minnesota—U S Eng, 1217 U S Post Office & Customhouse, St. Paul, plans enlarging plant. $5,000,000.

Minn., Rushford and Lanesboro—Dairyland Power Co-operative, Arcadia, Wis., plans constructing imprv, enlarging power plant, Rushford and Lanesboro. $45,000.

Neb., Lincoln—City bids soon constructing pump house. Total est $25,000. D L Erickson, city engr.

N. C., Morganton—National Carbon Co, Inc, 30 E 42 St, New York, N. Y., plans constructing metallurgical and chemical plant, 48 acre tract selected. $6,000,000.

Ohio, Amherst—Village, Bd P Affairs, plans imprv electric generating plant. Contr 2, revised furnishing, installing turbo-generating units. F S Browne, Marion Bldg, Marion, engr.

Ohio, Canton—Ohio Power Co, 305 Cleveland Ave S W, plans constructing substation, Georgetown Rd. $500,000.

Ohio—Industrial company plans constructing mfg plant. $20,000,000. McGeorge & Hargett, 9400 Quincy Ave, Cleveland, engrs. Defense Plant Corp will finance.

Pennsylvania—Carnegie-Illinois Steel Corp, J L Perry, pres, Carnegie Bldg, Pittsburgh, receiving bids constructing general contract brick pump sta and equip. $50,000-$100,000. J M Rice, Century Bldg, Pittsburgh, designing engr.

Texas—Goodyear Tire & Rubber Co, 1141 E Market St, Akron, O., plans constructing plant. $9,000,000. Federally financed.

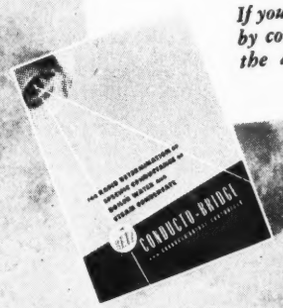
★★★ GREAT TO FISH IN but UNFIT for Industrial Use

Surface waters cascading over rocks and lying quiescent in shaded pools offer an impelling lure to the angler. Even though crystal-clear, however, such water is practically never suitable in its natural state for steam generation, processing or other industrial needs.

Any water from river, deep well or other natural source requires study and treatment before use, to safeguard and prolong the life of boilers and other plant equipment operating under today's heavy demands. The Betz organization of engineers and chemists is trained and skilled in the conditioning of any water for any industrial use. For any plant, however large or small, Betz stands ready to render a complete water service—of consultation, research, design and supervision.

Write for complete information, giving details of your particular problems.

If you are interested in steam purity and its safeguarding by conductivity instruments, write for booklet describing the accurate, rugged low cost Betz Conducto-Bridge.



W. H. & L. D. BETZ

Consultants on ALL Water Problems

FRANKFORD • PHILADELPHIA • PENNSYLVANIA

LABORATORIES AND ENGINEERS LOCATED THROUGHOUT U. S. A. AND CANADA

Incendiary Bombs FROM SEA WATER

BUELL DUST RECOVERY SYSTEMS PLAY AN IMPORTANT PART

The sea is a limitless source of magnesium—the "miracle metal" that's both fire for incendiary bombs and lightness and strength for the bombers that drop them.

Extracting millions of pounds of magnesium from sea water is the big job of one of America's biggest chemical producers. Details, of course, are secret but Buell Dust Collectors play an important part. The patented van Tongeren cyclone (an exclusive feature of Buell Dust Recovery Systems) offers exceptionally high efficiency without increasing operating cost. Buell equipment is widely used in

CHEMICAL & PROCESS INDUSTRIES
ROCK PRODUCTS INDUSTRY
FOUNDRIES
POWER PLANTS
METALLURGICAL AND OTHER INDUSTRIES

If your business has a dust problem, it will pay you to investigate the many advantages of Buell Dust Recovery Systems. Ask to see a Buell engineer.

For the complete Buell story write for BULLETIN P-9

BUELL ENGINEERING COMPANY, Inc.
10 Cedar Street, New York
Sales Representatives in Principal Cities

CONSULT BUELL *First* IN DUST RECOVERY
for Chemical • Rock Product • Metallic • Food • Flue or any other dusts

buell DUST RECOVERY SYSTEMS

Texas—Goodrich Rubber Co, 500 S Main St, Akron, O., plans constructing plant. $16,000,000. Federally financed.

Washington—Bids Aug 5, by Bureau Reclamation, Denver, Colo., for fabricated structural steel for transformer-circuit structures for Units L-1, L-2, L-4, L-5 and L-6 at Grand Coulee power plant, Columbia Basin project, Spec 1653-D.

Wyo., Laramie—E W Waddleton, city clerk, plans $1,500,000 bond election July 28 constructing light plant.

Pacific Northwest—U S Eng, Textile Power, Seattle, plans constructing standby power plant.

Contracts Let

Alabama—Industrial company, awarded contract constructing plant, to Cunningham Rudy Co, 3087 W Grand Blvd, Detroit, Mich.; equipment design and installation, to Foster Wheeler Co, 165 Bway, New York, N. Y. Total est $1,250,000. Defense Plant Corp will finance. Giffels & Vallet, Inc, 1000 Marquette Bldg, Detroit, Mich., engrs.

Alabama—U S Eng, 306 Courthouse, Nashville, Tenn., awarded contract constructing electric substation to F W Owens Co, 119 N 5 St, Louisville, Ky. Est less than $1,000,000.

Arizona—U S Eng, 751 S Figueroa St, Los Angeles, Calif., awarded contract constructing electrical transmission line and substation, to Arizona Edison Co, Casa Grande; electric distr sys, to New State Electric Co, 214 W Washington St, Phoenix.

California — Industrial Company, awarded contract constructing plant to Ford J Twaits Co, 451 S Boyleston Ave, Los Angeles. Est $5,500,000. Federally financed. J Gordon Turnbull, Citizens Bldg, Cleveland, O., engr and archt.

California—Industrial company awarded contract for design and construction plant, to Stone & Webster Co, 601 W 5 St, Los Angeles. Defense Plant Corp will finance. $5,000,000.

California—Industrial company awarded contract constructing plant, to Camn Bros, 206 Sansome St, San Francisco. Est about $12,000,000. Defense Plant Corp will finance.

Connecticut — Industrial company awarded contract constructing mfg unit, School St, to Bartlett-Brainard Co, 103 Woodbine St, Hartford. Est $1,000,000.

Connecticut—Pub Housing Auth, NHA, 24 School St, Boston, Mass, awarded contract constructing site imprvs, community bldg, water, sewer and electric utilities, CONN 6018, to Lindholm Constr Co, Inc, 1277 East St, Pittsfield, $1,000,000.

Florida—U S Eng, Postoffice & Courthouse, Jacksonville, awarded contract constructing lighting sys, to J R Hine Elec Co, Palm Beach, less than $1,000,000.

Florida—U S Eng, Courthouse & Postoffice, Jacksonville, awarded contract constructing lighting sys, Inv 436-43-479, to Johnson & Gormly, Jacksonville, less than $1,000,000.

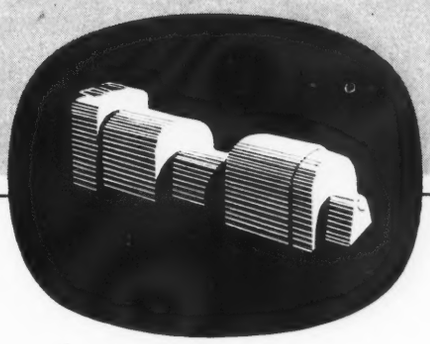
Florida—U S Eng, Courthouse & Postoffice, Jacksonville, awarded contract constructing lighting sys, Inv 436-42-480, to Johnson & Gormly, Jacksonville, less than $1,000,000.

Florida—U S Eng, Courthouse & Postoffice, Jacksonville, awarded contract constructing electrical distr sys, to Bigby Elec Co, Inc, 305 Franklin St, Tampa, less than $1,000,000.

GULFCREST OIL

is ALCHLOR PROCESSED—

Your assurance that it provides better turbine protection!



Gulf's Alchlor Process is the most effective method known for removing impurities and unstable hydrocarbons from oil.

YOU are sure of better protection for your turbines when you put Gulfcrest Oil in service. For this highest quality lubricating oil is not only refined by conventional methods, but is super-refined by the Gulf Alchlor Process, the most effective method yet known for removing impurities and unstable hydrocarbons from oil—the undesirable constituents which cause oxidation and gum and sludge formation.

After years of service, Gulfcrest Oil shows so little evidence of deterioration that users report it is in substantially as good condition as when first put into the turbine lubricating system. Gulfcrest Oil is the world's finest oil for turbine lubrication!

Send the coupon below for the story of Gulfcrest Oil and what it can do for you—no obligation, of course.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company P.
3800 Gulf Building, Pittsburgh, Pa.

Please send me my copy no charge of the brochure "Gulfcrest Turbine Oil."

Name _____

Company _____

Address _____

FASTER TUBE CLEANING INCREASES WAR PRODUCTION USE WILSON TUBE CLEANERS

The prevention of *all* waste is now not only "good business"—it is a national duty. Boilers must operate at their maximum efficiency and for longer periods between cleanings than ever before. Every pound of coal—every gallon of fuel oil—used for generating steam that can be saved *must* be saved and tube cleaning time *must* be reduced to the minimum. One of the surest ways to reduce both fuel consumption and tube cleaning time and also to keep boilers on steam longer is to use Wilson Tube Cleaners. They clean tubes *better, faster* and *more economically* because they have *more power, more speed, use less air* and *last longer.*

There is a Wilson Tube Cleaner, cutter head, brush or other accessory for *quickly* and *thoroughly* cleaning *any* straight or curved ferrous or non-ferrous tube of large or small diameter.

Write for the name of our representative nearest to you or ask for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.

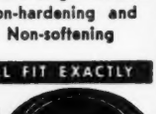
BETTER SERVICE — SAFETY — SATISFACTION
FOR REPLACEMENTS ORDER

PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

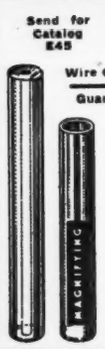
GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket



Send for Glass and Gasket Chart

Shipment made by parcel post the same day as order is received



Send for Catalog E45

Wire Glass Guards

ERNST WATER COLUMN & GAGE CO.
RUBBER & GLASS DIVISION LIVINGSTON, NEW JERSEY

Florida—U S Eng, Courthouse & Postoffice, Jacksonville, awarded contract constructing steam distr sys, to Palm Beach Plumbing Co, 115 Lakeview Ave, Palm Beach, less than $1,000,000.

Georgia—U S Eng, Courthouse & Postoffice, Jacksonville, Fla., awarded contract constructing electrical distr sys, to Ive H Smith, 1525 San Mario Blvd, S Jacksonville, Fla., less than $1,000,000.

Georgia—U S Eng, Courthouse & Postoffice, Jacksonville, Fla., awarded contract constructing lighting sys, Inv 436-42-478, to Randall Elec Co, Spartansburg, S. C., under $1,000,000.

Indiana—Industrial company awarded contract constructing plant, to John Griffiths & Son, 228 N La Salle St, Chicago, Ill. Est about $10,000,000. Defense Plant Corp will finance. Shaw, Naess & Murphy, 80 E Jackson Blvd, Chicago, Ill., archts.

Me., Springfield—Springfield Gas & Electric Co, E S Ellever, mgr, 324 E Walnut St, awarded contract constructing imprv, exten power plant fdn, to W W Johnson, Phelps Grove; boiler installation, to Stearns-Rogers Mfg Co, 1720 California St, Denver, Colo. Est $228,000.

Minn., Springfield—A C Mueller, city clerk, awarded contract constructing improv, municipal light and power plant, to William Bros Boiler & Mfg Co, Nicollet Island, Minneapolis, 3 drum boiler at $53,668.

North Carolina—National Carbon Co, Inc, 30 E 42 St, New York, N. Y., awarded contract constructing plant, to Gillmore, Carmichael, Olsen Co, 1873 E 55 St, Cleveland, O. Total est $6,000,000. Defense Plant Corp will finance.

Ohio—Industrial co awarded contract constructing plant to Alger-Rau, Inc, 12434 Cedar Rd, Cleveland. Est $3,000,000. Defense Plant Corp will finance. R F McDowell, Chester Bldg, Cleveland, engr.

Ohio—Company awarded contract constructing heat-treating plant, to Brown Constr Co, 1900 Euclid Ave, Cleveland. Est $150,000.

Ohio—U S Eng, Wright Field, Dayton, awarded contract constructing emergency power plant, Montgomery Co, to B G Danis Co, 1518 E 1 St, Dayton, under $50,000.

Oklahoma—U S Eng, Denison, Tex., awarded contract constructing underground utilities, to Parrott-Oldt Co, 403 S Haskell St, Dallas. Total est over $1,000,000.

Pennsylvania — Industrial company awarded contract constructing plant, to Rust Engineering Co, Clark Bldg, Pittsburgh. Est over $5,000,000. Federally financed. Prack & Prack, 517 Martin Bldg, N S Pittsburgh and Janssen & Cocken, 800 Century Bldg, Pittsburgh, archts. Morris Knowles, Inc, 1312 Park Bldg, Pittsburgh, engrs.

Pennsylvania — Industrial company awarded contract, design and construction power plant, to Gibbs & Hill, 450-7 Ave, New York, N. Y. Est over $5,000,000. Defense Plant Corp will finance.

Pa., Williamsport—Pennsylvania Power & Light Co, Williamsport, awarded contract for boiler unit at steam generating plant, foot of Hepburn St, separate contracts. $40,000.

Tennessee—Caine Steel Co, 1820 N Central St, Chicago, Ill., awarded contract constructing plant, to Lee Constr Co, 1467 Lamar Ave, Memphis, under $1,000,000 cost plus. Federally financed. R B Spencer, 1st Natl Bank Bldg, Memphis, archt.

Do you need more steam right now?

A Steel Plant installed Enco Streamlined Baffles and increased the output of its boilers 50%

A large steel plant* did need more steam and needed it at once. A new boiler was being considered but involved months of waiting.

A study of their four bent tube boilers showed that a change to Enco Streamlined Baffles would add considerably to their total steam output. Enco Baffles were installed at the rate of one boiler per week, and their operating records now show 50% increase in output under usual load conditions. During an emergency test, the full load was carried with two instead of four boilers.

This improvement in capacity was made with no measurable increase in flue gas temperature and for the comparatively small cost of new baffle walls.

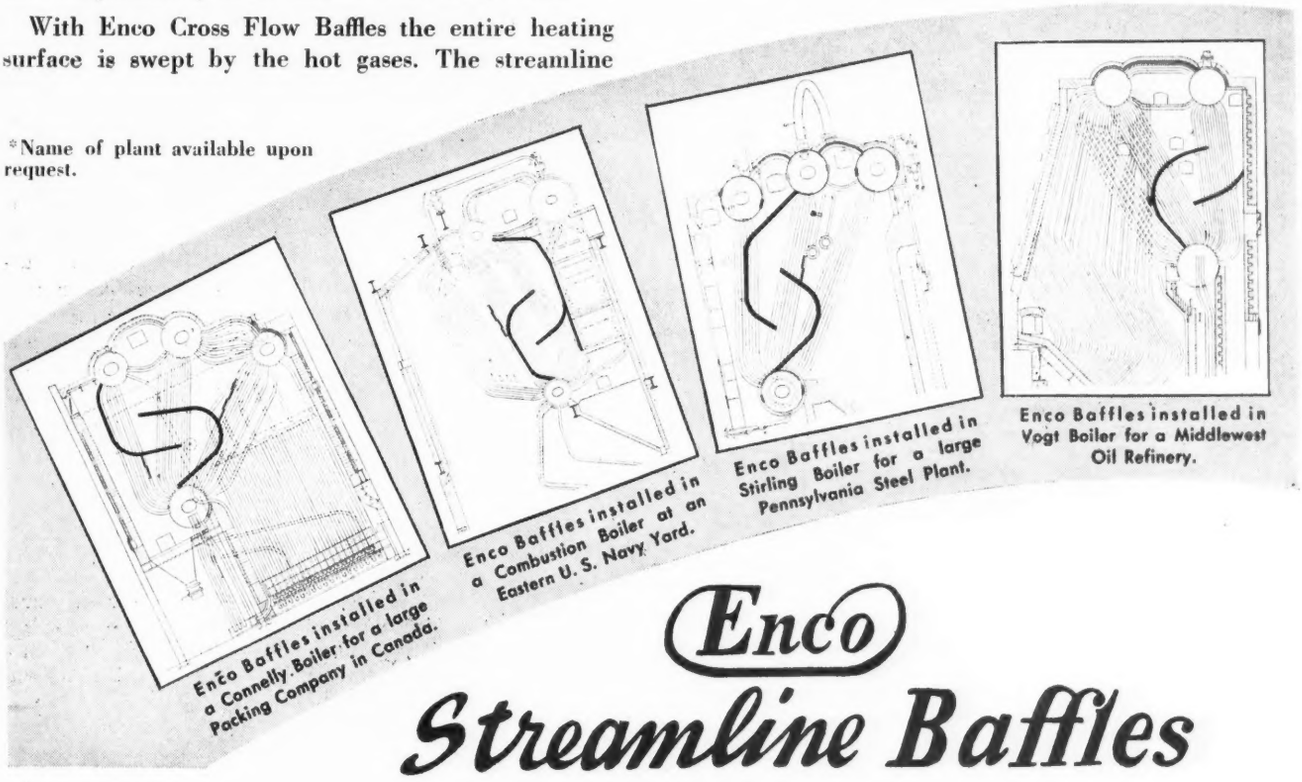
With Enco Cross Flow Baffles the entire heating surface is swept by the hot gases. The streamline principal makes a material reduction in the draft drop, producing highly improved efficiency and output of the boiler.

Enco Baffle Walls are correctly designed for either horizontal or vertical bent tube boilers. They are installed by skilled mechanics with the materials shown by years of experience to be best for the purpose.

Write for Bulletin BW-40, "Modern Practice in Baffle Wall Design and Construction," or for quick action send blueprint and operating data to learn what we can do for you.

The Engineer Company, 75 West Street, New York, N. Y.

*Name of plant available upon request.



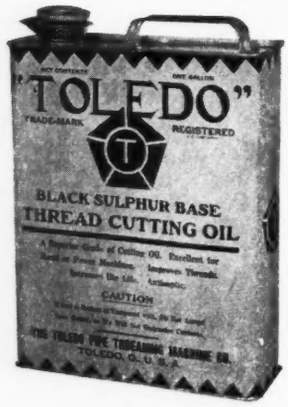
Enco Baffles installed in a Connelly Boiler for a large Packing Company in Canada.

Enco Baffles installed in a Combustion Boiler at an Eastern U. S. Navy Yard.

Enco Baffles installed in Stirling Boiler for a large Pennsylvania Steel Plant.

Enco Baffles installed in Vogt Boiler for a Middlewest Oil Refinery.

Enco Streamline Baffles



IT DOES MAKE A DIFFERENCE

Steel is scarce and it's important that every one conserve it. One sure way to increase die life is by using "TOLEDO" cutting oil. You will be amazed at the results—

easier cutting
cleaner threads
longer die life

When your dies do become dull—don't throw them away. We will be glad to regrind them for a nominal charge.

KEEP THEM SHARP

Save steel for victory.
Save money by regrinding your old dies.

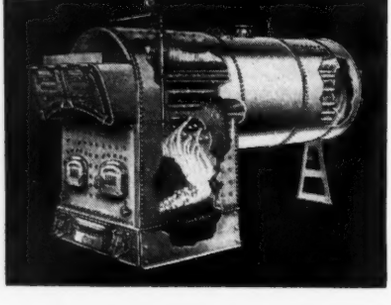
"TOLEDO"

TOLEDO PIPE THREADING MACH. CO.

TOLEDO, OHIO **NEW YORK, N. Y.**

KEWANEE FIRE BOX BOILERS

Extra Strength . . . for Heavy Duty



100, 125 and 150 lbs. W.P. . . . sizes for 4 to 300 Horse Power. Their known strength, steel plus rivets supplemented by extra stout stays and braces in the boiler shell, adds extra years of service.

For 6" rule with scale for reading pipe sizes, write Dept. 96 K-IX.

KEWANEE BOILER CORPORATION Kewanee, Illinois

Tennessee—Industrial company awarded contract constructing plant, to L O Stocker, Arcade Bldg, St. Louis, Mo., about $1,000,000. Federally financed.

Texas—Anglo American Trading Corp, c/o W B Hatch, 90 Broad St, New York, N. Y., plans constructing plants.

Texas — Industrial company plant awarded contract constructing to Lummus Co, 420 Lexington Ave, New York, N. Y. $38,000,000. Defense Plant Corp will finance.

Texas — Industrial company awarded contract design and construction plant unit, to Stone & Webster Eng Corp, 49 Federal St, Boston, Mass., $12,000,000. Defense Plant Corp will finance.

Texas — Industrial company awarded contract constructing plant, to Arthur G McKee & Co, 2300 Chester Ave, Cleveland, O., $1,500,000. Federally financed.

Texas — Industrial company awarded contract constructing plant, to Arthur G McGee & Co, 2300 Chester Ave, Cleveland, O., $1,200,000. Federally financed.

Texas — Industrial company awarded contract for design and construction plant, to Geo A Fuller Co, 597 Madison Ave, New York, N. Y., $8,000,000. Federally financed.

Texas — Industrial company awarded contract for design and construction plant, to Geo A Fuller Co, 597 Madison Ave, New York, N. Y. $9,000,000. Federally financed.

Texas — Industrial company awarded contract constructing plant, to P Wood, Sweeney, $2,000,000. Federally financed.

Utah—U S Eng, 32 Exchange Pl, Salt Lake City, awarded contract constructing plant, to W E Callahan Constr Co, 715 W Olympic Bldg, Los Angeles, Calif., less than $3,000,000. Bids 7/8; Bldg, to H Dorman, 224 Interurban Bldg, Salt Lake City, $247,000.

Power Lines

(*Continued from page* 131)

diesel engine sales, according to an announcement by Duncan W Fraser, president. Diesel locomotive sales remain under the supervision of Perry T Egbert.

Mr Corrigan, who was a captain in the artillery ordnance branch of the US Army during the last war, has participated in the negotiation of various recent government contracts with American Locomotive Co for the production of ordnance and other war materials. The company is making tanks, gun carriages, marine diesels, shells, bombs and heavy forgings.

Arno C Fieldner Medal Recipient

The Melchett medal, awarded annually by the Institute of Fuel of England. for outstanding achievement in work involving the scientific preparation or use of fuel, will be presented this year to Dr Arno C Fieldner. Chief of the Technologic Branch and Chief of the

WE MUST WIN THIS WAR

To win the war—and the peace that follows—we must maintain efficient production in all industrial plants. Every man-hour and every machine-hour counts!

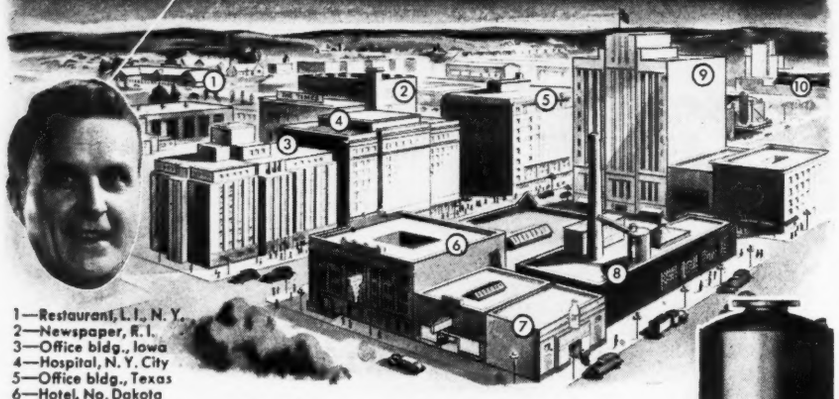
Garlock continues to make packings, gaskets and oil seals which give long, dependable service. They help industry maintain full production schedules.

GARLOCK

THE GARLOCK PACKING CO.
PALMYRA, N. Y.

In Canada:
The Garlock Packing Co.
of Canada Ltd., Montreal, Que.

You could live in Diesel Town,* U.S.A., without hearing exhaust noise



1—Restaurant, L. I., N. Y.
2—Newspaper, R. I.
3—Office bldg., Iowa
4—Hospital, N. Y. City
5—Office bldg., Texas
6—Hotel, No. Dakota
7—Dairy store, Mo.
8—Large dairy, Chi.
9—Office bldg., Fla.
10—Water works, Ohio

*Diesel Town—an imaginary city made up of real buildings. Each one has an actual installation of Diesel engines equipped with Burgess Snubbers to provide quiet exhausts.

Snubbers make Diesel Exhausts Quiet

There was a time when Diesel engine operation meant Diesel exhaust noise. That time passed when Diesel operators discovered they could operate their engines efficiently—without exhaust noise—by snubbing the noise-making "slugs" of exhaust gases which would otherwise shoot out of the engine and cause noise.

Now you can live next door to a Diesel plant without knowing it, if its engines are equipped with Burgess Exhaust Snubbers. The buildings shown above are only a few of the many successful Burgess Snubber installations where the advantages of Diesel power are being enjoyed without exhaust noise complaints. Snubbers smooth the pulsating flow of exhaust gases to a quiet stream. There is no interference with the efficient operation of any Diesel engine. Burgess Battery Company, Acoustic Division, 2823-L West Roscoe Street, Chicago.

Originators of Patented Snubbing Principle for Quieting Diesel Exhausts.

Cross sectional view of Burgess STC Snubber, used for preventing exhaust noise of Diesel engines.

BURGESS DIESEL EXHAUST SNUBBERS

Cuts your gasket costs in half

The most remarkable tool ever invented

Write for booklet

THE ALLPAX GASKET CUTTER

Manufactured by

THE ALLPAX COMPANY, INC.

Distributors everywhere *Mamaroneck, N. Y.*

Coal Division, Bureau of Mines, according to advices received from the Council of the British Institute of Fuel by the Department of the Interior.

Dr Fieldner, a chemical engineer and scientific research worker for 35 years in the Department, thus will become the second American so honored since the medal was first awarded in 1930. Among the earlier recipients of the award are: Charles M Schwab, of the United States; Sir John Cadman (the late Lord Cadman), of England; Dr F Bergius of Germany; and Mon Etienne Audibert of France.

American Industries Salvage Committee

Formation of the American Industries Salavge Committee, representing groups of leading industrial concerns who are working with the Conservation Division of the War Production Board to help speed the collection of vital scrap materials, has been announced by Robert W Wolcott, chairman of the group and president of the Lukens Steel Co. Other members of the administrative committee directing the nationwide $2,000,000 campaign, are: Charles R Hook, president of the American Rolling Mill Co, vice-chairman; R S Wilson, representing Rubber Manufacturers Association; and O E Mount, representing Steel Founders' Society of America. The work of the committee, backing up a broad advertising program, will be two-fold: one, to reach every manufacturing and business firm in the nation to impress upon them the absolute necessity of getting their scrap on the way to the production lines; and, two, to get business men cooperating with the local salvage committees of WPB already set up in 12,000 communities.

The activities of the committee will be closely coordinated with the present intensified scrap collection drive of the WPB, according to Mr Wolcott. In this connection, the committee is underwriting the cost of an extensive national advertising campaign approved by the War Production Board.

Scrap Quotas

Minimum quotas for steel, iron and steel scrap to be sent to steel mills, have been prepared and published by the War Production Board, by Paul C Cabot, Deputy Director, Conservation Division. The release states, in part:

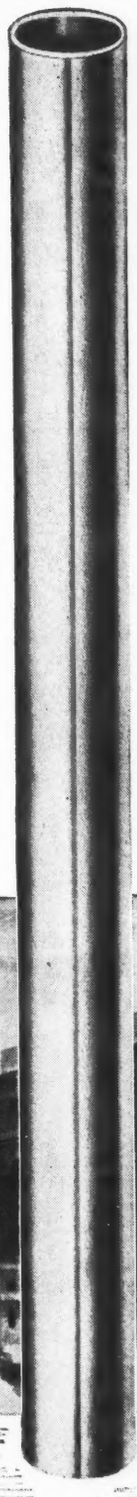
"At the present time inventories are dangerously low—on a nationwide basis, a little more than one month's supply. Inventories at the end of June

G-L-O-B-E SPELLS SAFETY AND SAVINGS IN PRESSURE TUBES

Service records in many of the nation's noteworthy power plants — their use by leading railroads, industrial and marine boiler builders — attest the greater value, safety and savings of Globe Steel Tubes.

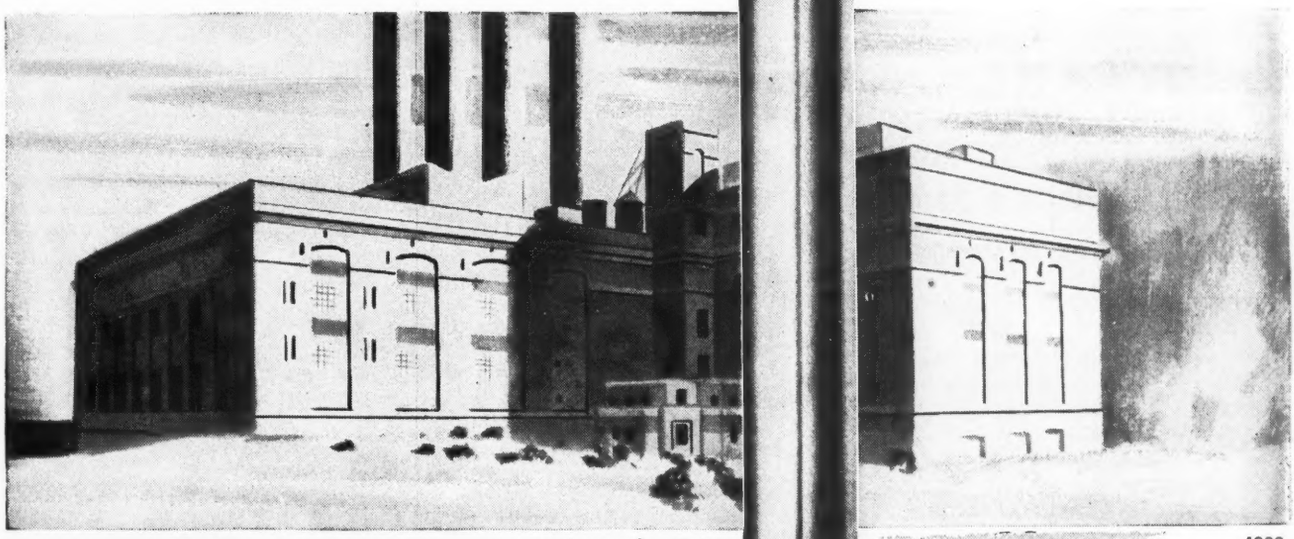
Their extra margin of safety and strength — particularly vital to meet modern high pressure and temperature demands — more than offsets any immediate advantage of lower first cost.

GLOBE STEEL TUBES CO.



Globe engineers are always available to assist in selecting a tube with the exact characteristics you require.

MILWAUKEE, WIS.



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GLOBE TUBES

GLOBE STEEL TUBES

- Stainless Tubes
- Condenser and Heat Exchanger Tubes
- Boiler Tubes
- Mechanical Tubing

PRACTICAL SUBSTITUTES FOR *Tin Base* BABBITTS

Magnolia has developed two new lead-base bearing metals which effectively "pinch hit" for tin-base babbitts. These, together with Magnolia Anti-friction Metal, fill practically all bearing metal requirements.

● **MAGNOLIA Anti-friction METAL** for steady, high speeds and uniform loads.

● **PYRAMID Bearing METAL** withstands extremely heavy, sustained pressures.

● **DEFENDER Bearing METAL** stands up under shock loads without cracking.

New Bulletin giving full details, specifications on all Magnolia Metals sent free on request.

MAGNOLIA METAL CO. • ELIZABETH, N. J.

MAGNOLIA BEARING METALS

ADAMANT
FIRE BRICK CEMENT

. . . lengthens the periods between relinings!

The use of Adamant Cement assures longer life for brickwork constructions because its high bonding strength makes the joints strong as the brick they bond. Impartial laboratory tests showed an average modulus for Adamant of 800 lbs. per sq. in. at room temperature . . . 1270 lbs. per sq. in. at 2600° F. Adamant is easy to use . . . comes ready mixed. Write for literature.

Adamant has a P. C. E. of over 3000° F.

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto.

CONSERVE YOUR FUEL OIL

BY TREATING IT WITH *KIL-SLUDG*

Eliminate sludge conditions in tanks, pipe lines and preheaters with KIL-SLUDG and assure complete combustion of fuel oil.

KIL-SLUDG—specially compounded for effective treating of fuel oil—reduces viscosity of sludge so that full heat value of oil is assured, fuel cost reduced and excessive smoke and soot conditions eliminated.

TRY IT TODAY!

Send trial order at once advising the nature of the sludge problem you want to solve. Ask for further details.

STANDARD CHEMICAL CO.
NATICK, MASS.

were estimated at about 3,000,000 net tons as against 2,500,000 on Jan. 1. We must enter the winter with a substantial inventory if we are to be assured of maximum steel production. In the first six months of this year it was estimated that there were shipped from all collecting sources, according to figures compiled by the United States Bureau of Mines, around 13,700,000 net tons of iron and steel scrap. We must collect and ship to mills a total of 17,000,000 net tons between July 1 and Dec. 31."

Region 3, comprising Pennsylvania, Maryland, Delaware, Virginia, and Washington, D. C., has the largest quota, 3,422,000 tons.

Region 6, made up of Indiana, Illinois, Iowa and Wisconsin, has the next largest quota, 3,125,000 tons.

The lowest single state quota is that of Nevada, 3500 tons.

American Welding Society to Meet October 12-15

The 1942 annual meeting of the American Welding Society will be held in Cleveland, Ohio, Oct. 12-15. Papers of interest to power men, include:

Effect of Cooling Rate on the Properties of Arc Welded Joints, by W F Hess, Rensselaer Polytechnic Institute; Fatigue Strength of Metal Subjected to Combined Stresses, by L H Donnell, Illinois Institute of Technology; Some Special Applications of Flame Hardening, by Stephen Smith, Air Reduction Sales Co; High Quality Welding—Vertical and Overhead Positions with Alternating Current, by H O Westendarp, General Electric Co; Conservation and Effective Use of Equipment and Supplies for Welding and Cutting, by H Ullmer, the Linde Air Products Co; Arc Welding of Magnesium Alloys, by W S Loose and A R Orban of the Dow Chemical Co.

Link-Belt Honors James Mapes Dodge

In tribute to the memory of James Mapes Dodge, one of the founders of Link-Belt Company, a great engineer, inventor, leader and humanitarian, June 30th was declared "James Mapes Dodge Day," celebrated with fitting ceremony at the company's Nicetown, Philadelphia, plant.

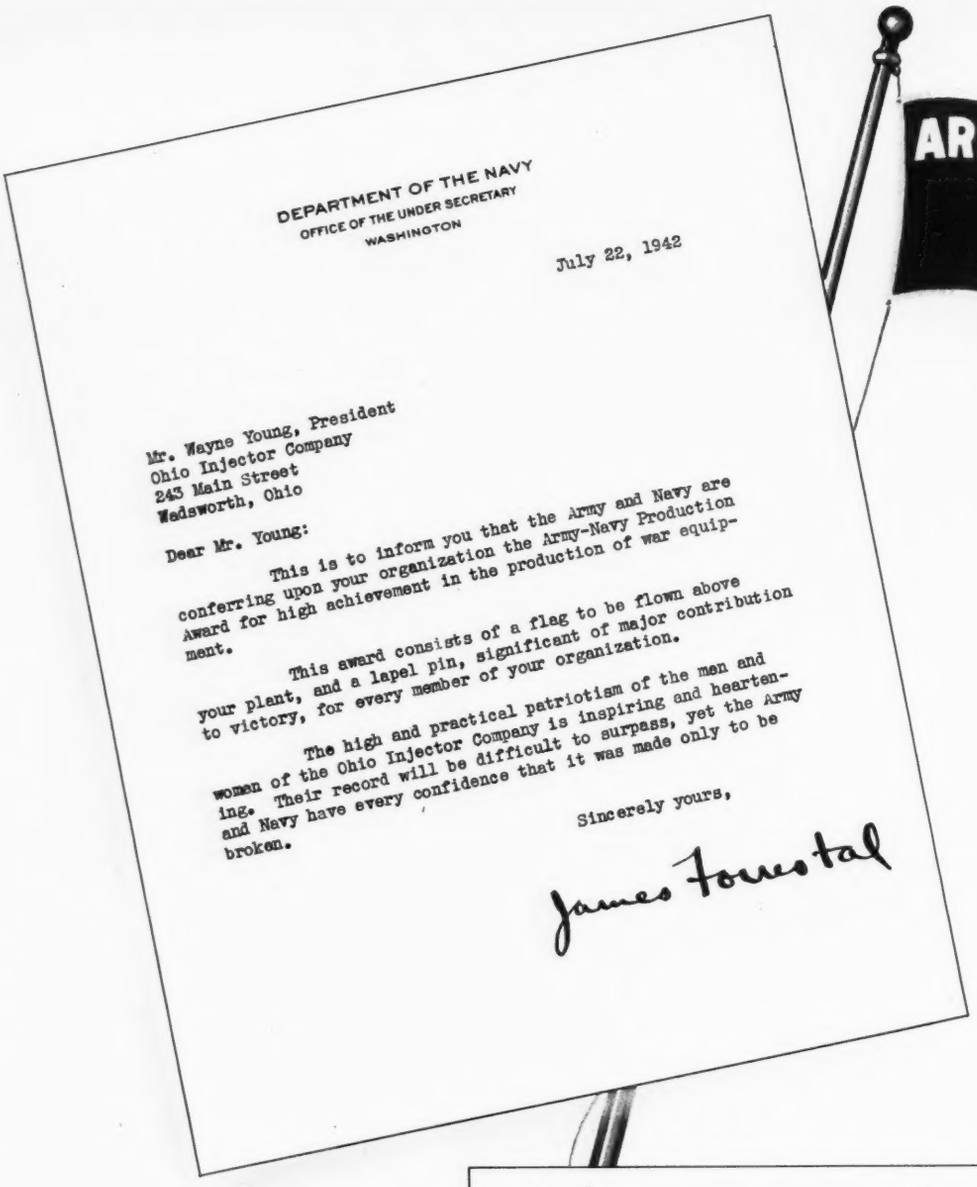
Mr Dodge was chairman of the board of the Link-Belt Company, with headquarters at the Nicetown plant, at the time of his death in 1915, at the age of 63. June 30th marked the 90th anni-

"-for high ACHIEVEMENT"

THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883



DEPARTMENT OF THE NAVY
OFFICE OF THE UNDER SECRETARY
WASHINGTON

July 22, 1942

Mr. Wayne Young, President
Ohio Injector Company
243 Main Street
Wadsworth, Ohio

Dear Mr. Young:

This is to inform you that the Army and Navy are conferring upon your organization the Army-Navy Production Award for high achievement in the production of war equipment.

This award consists of a flag to be flown above your plant, and a lapel pin, significant of major contribution to victory, for every member of your organization.

The high and practical patriotism of the men and women of the Ohio Injector Company is inspiring and heartening. Their record will be difficult to surpass, yet the Army and Navy have every confidence that it was made only to be broken.

Sincerely yours,

James Forrestal

A message to our Distributors, their OIC *Customers, and our Suppliers:*

You rightfully share with us in this Army-Navy Production Award. Thank you sincerely for your splendid co-operation.

OIC

THE OHIO INJECTOR COMPANY

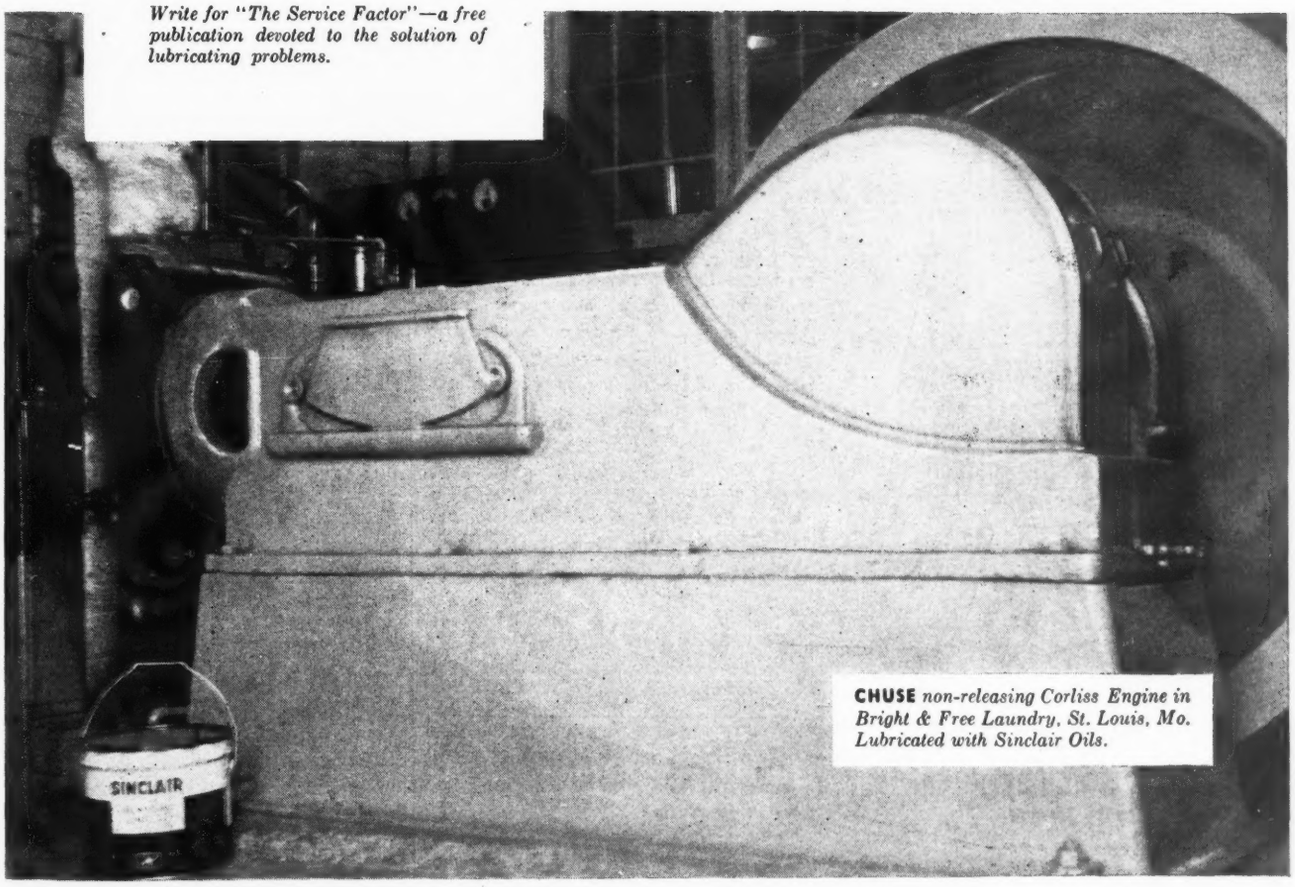
WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883

FRONT LINE MIGHT rests on rear line power. *STEAM ENGINES* deliver full designed horsepower when lubricated with . . .

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils provide *correct* steam plant lubrication and meet all steam recovery requirements.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



CHUSE *non-releasing Corliss Engine in Bright & Free Laundry, St. Louis, Mo. Lubricated with Sinclair Oils.*

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

(Above) Roto Model 105 motor with chain joint and drill head for superheater tubes.

(Right) Roto Model 125 motor with long 4-arm head for curved tubes.

ROTO

Does a Quick, Clean Job in any Cleanable Tube

Roto offers a complete line of tube cleaners to meet practically every power plant requirement, effectively and economically. Air, steam and water-driven models are available for cleaning straight or curved tubes and pipes in boilers, superheaters, transfer lines, economizers and condensers, from ½" I. D. up. We have a wide range of cutter heads, scrapers and brushes to remove hard scale and soft, gummy deposits. Share our 32 years' experience as tube cleaner specialists by letting us serve you.

SEE OUR ADV. IN SWEET'S

The ROTO Company

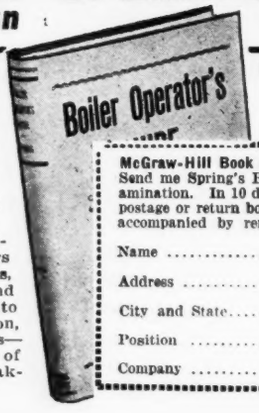
145 SUSSEX AVENUE, NEWARK, N. J.

THIS NEW BOILER OPERATOR'S GUIDE . . . can mean money to you!

Here's information of the most priceless sort for you—whether you want to improve your ability as an inspector or to utilize effective inspection methods in the more efficient, safer operation and upkeep of your own boilers.

Helps you meet everyday problems; Prepares you for license exams

With hundreds of typical examination questions and answers as well as complete instructions, this book presents fully and plainly the things you want to know about proper installation, operation, and care of boilers—the things that prevent dollars of loss in reduced efficiency, breakdown, or even accident.



By H. M. Spring, Jr.
353 pages, 6 x 9
241 illustrations
$3.00

Examine a Copy for 10 Days on Approval

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.
Send me Spring's Boiler Operator's Guide for 10 days' examination. In 10 days I will send you $3.00, plus few cents postage or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....

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City and State .....

Position .....

Company .....FP. 9-42

versary of his birth. In attendance at the ceremony were the directors and officials of the company and employees who had the privilege of personally knowing Mr Dodge and working with him.

Howard Coonley, director of the company, and son of another Link-Belt pioneer, John C Coonley, who is also chairman of the board of the National Association of Manufacturers, delivered the main address. Mrs James Mapes Dodge presented to the company a portrait of her husband, which was accepted by Laurence Ewell, general manager at Philadelphia. Mr. Kern Dodge, son of James Mapes Dodge, and for many years director of the company, spoke briefly in appreciation.

Power Recovery from Waste Gas

Installation of a 3,500-hp General Electric gas turbine by a California concern producing 100-octane aviation gasoline highlights the recent development of such power-recovery units.

During one of the steps of aviation-gasoline manufacture, petroleum vapor passes through catalytic reactors, which change the chemical composition of the vapor. Incidental to this reaction, a deposit of carbon is left on the catalyst. The carbon must be removed periodically, and this is accomplished by shutting off the flow of petroleum vapor and forcing air through the reactor by a blower. During this stage, the carbon is burned off, and the heated air, as a result, then contains carbon-dioxide. As this gas leaves the reactor, it enters and drives a gas turbine which in turn supplies motive power for the blower. The result is conversion into valuable power of what otherwise would be piped off as waste gas.

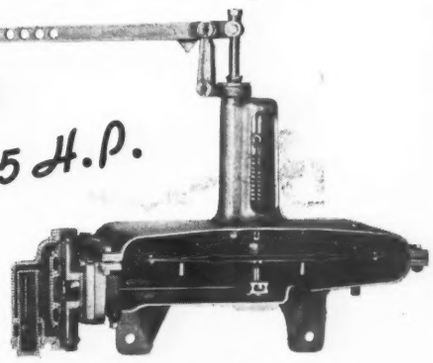
Oil refineries, however, are just one potential source of power derived from processed gas. Various types of plants using natural gas also, now have gas-turbine installations. For example, manufacturers of carbon black obtain their product by extracting it from natural gas. The process requires gas at a comparatively low pressure. Gas turbine may be used as a reducing valve to adopt the normally high pressure from the well to the process, and at the same time obtain valuable energy. In 1939, General Electric installed its first gas turbines, of 98 and 265 hp, respectively, and since then increasingly large turbines have been supplied. While gas turbines are already installed for power recovery and are conserving sizeable amounts of energy needed by war

Stretch YOUR FUEL TO ITS GREATEST PRODUCTIVE VALUE . . .

YOU can achieve quick and continuous fuel savings by making your coal, oil, or gas (whichever you burn) give you the most in results. You can make your boiler room become a greater factor in production as you keep fuel consumption low. This is all accomplished by furnace draft control, air flow control, and fuel feed control. Each of these units is described below.

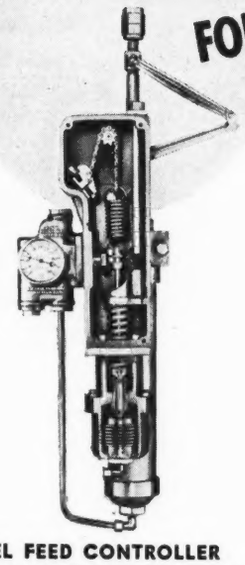
Hooked up together in an automatic system these CASH STANDARD units meter the fuel supply, continually adjust air supply as required, and operate the stack damper — to make your boiler room produce more steam with less fuel — to help you conserve manpower by cutting attendance time — to eliminate much waste.

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS FOR ALL TYPES OF PLANTS *Small as 75 H.P.*



AIR FLOW CONTROLLER
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

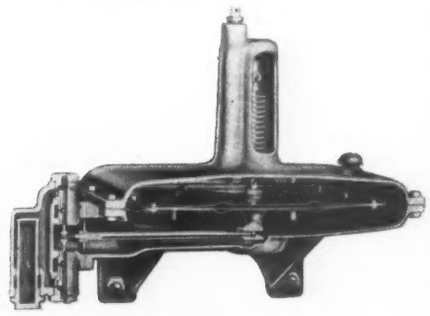
CORRECT FUEL FEED
You Save COAL, OIL OR GAS
PROPER AIR SUPPLY
YOU BURN FUEL *Economically*
CONSTANT OVER-FIRE DRAFT
You Prevent UNDUE STACK LOSS



FUEL FEED CONTROLLER
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

Bulletin Gives You Full Details on These Points SEND FOR IT . . . .

Bulletin No. 300 gives full details on Automatic Combustion Control for steam plant economy and shows applications of these systems for those who burn coal, oil or gas.

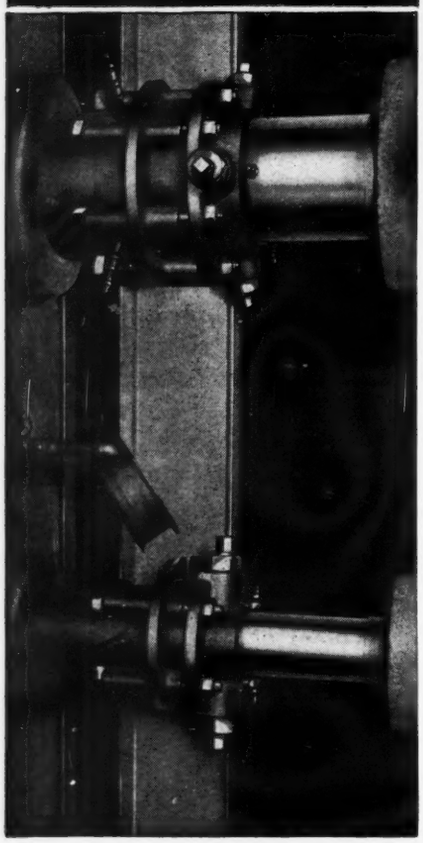


FURNACE DRAFT CONTROLLER
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

YARWAY
GUN-PAKT EXPANSION JOINTS



Big Automobile Company Uses 67 Yarway Joints

First purchased 3 years ago. Reordered 7 times to present total of 67 Yarway Gun-Pakt Joints, ranging in size from 3 in. to 14 in.

Why don't you select the Expansion Joint that is packed under full steam pressure. A twist of a wrench forces a special semi-plastic packing into the stuffing box by means of integral pressure guns. No need to remove old packing. New packing rejuvenates the old. No need to shut off steam. Write for Catalog EJ-1907.

YARNALL-WARING CO.
100 Mermaid Ave., Phila., Pa.

industry, full application of such systems cannot be expected to be realized until after the war. During the post-war period, however, when facilities for refinement in efficiency will be more plentiful, considerable development of power conservation technique is anticipated.

New Limiter for Industrial Power Systems

Development for war-factory power systems of a new noise-proof limiter that snuffs out 54,000 kw of electricity was described at the summer convention of the American Institute of Electrical Engineers by J M Wallace of the Westinghouse Electric & Manufacturing Company. The limiter has made possible a new sabotage-proof method of distributing high-voltage power in factories.

In recent tests in the Westinghouse Laboratory, limiters disconnected as much as 54,000 kw of momentary short-circuit electricity. However the average 600-volt factory power cable is expected to carry only 460 kw of electricity normally. Limiter is so designed that it will not go into action as soon as this normal power is exceeded, but will wait until a short-circuit power builds up to many times the normal amount. This delayed action is desirable, because most cables can carry an added electrical load for a short time.

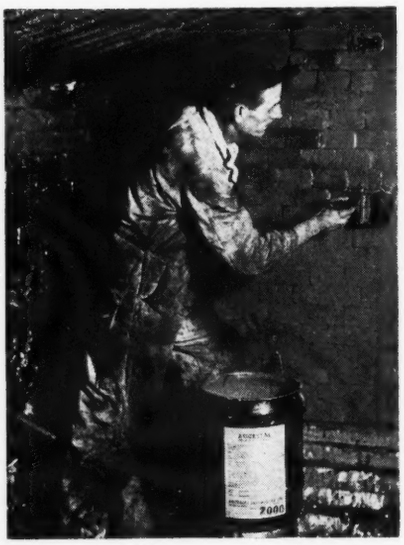
Circuit interruption is caused by heating, to 4000 F, a narrow section of the copper bar through which the electricity is flowing. Almost instantaneously copper vapor condenses to the solid state again, in the relatively cool inside surface of the copper container. This action makes possible the total inclosure of the device to eliminate noise. The outside of the container, however, never gets hotter than about 150 F. Heat of the flowing electricity also releases a blast of gas from a piece of fibrous material surrounding the bar. The gas quickly blows out the electric arc between the melted ends of the bar, extinguishing the flow of electricity.

OBITUARIES

WILLIS H TOWNE, western division manager of the Gifford-Wood Co, passed away July 26, 1942.

GEORGE B MCCULLOUGH, 57, plant superintendent of the Public Service Co of Charlottesville, Va., died July 6. He was a native of Norfolk, Va., and before coming to Charlottesville, was in charge of the Virginia Public Service Co plant at Bremo, Va., for nine years.

"BRICKSEAL" YOUR REFRACTORY LININGS



TRY THIS temperature-resisting armor plate — and minimize shutdowns

BRICKSEAL is the solution to the problem of frequent shutdowns caused by breakdowns in refractory linings. BRICKSEAL is the answer because it forms a highly glazed semi-plastic armor plate surface over the refractories and is impervious to temperature changes.

BRICKSEAL—a combination of high fusion clays and metals combined in oils—is available for all temperature conditions and is easily applied either by air spray or hand brush. It is unaffected by acids, alkalies or gases and will not crack, peel or blister. It provides a rugged binder for cracked and loosened fire brick as well as protection against clinkering, slagging or spalling. In furnaces fired with fuel oil, BRICKSEAL prevents absorption of any unignited oil by the refractories.

BRICKSEAL is being used today in practically every type of boiler and under all types of firing conditions—for new walls as well as for refractory maintenance.

Write today for full and complete information. It will pay you to have a BRICKSEAL man call.

DESIRABLE TERRITORIES AVAILABLE

Openings for sales representatives are available in certain desirable territories. Investigate!

BRICKSEAL REFRACTORY CO.
1029 CLINTON ST.
HOBOKEN, N. J.

THE WAR CAN'T WAIT..

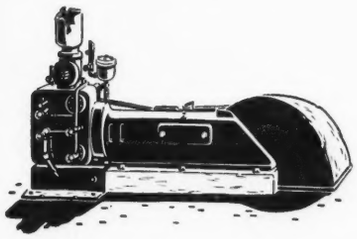
Donald M. Nelson says to Steam Electric Utilities:

"America's war production program must not be hamstrung by the present acute shortages of scrap materials—iron, steel, tin, rubber, copper, brass, lead, zinc, burlap, rags, and rope. We are counting heavily on the Nation's electric utilities to help whip this situation. Now is the time to survey your plants, to condemn old buildings, junk obsolete equipment, and round up odds and ends of valuable materials. We urge you to begin *at once* an intensive drive to rout the scrap from your plants!"

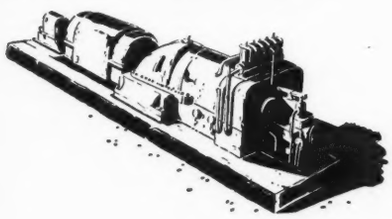
U.S. NEEDS ALL SCRAP..TODAY!

SELL YOUR SCRAP TO SHORTEN THE WAR!

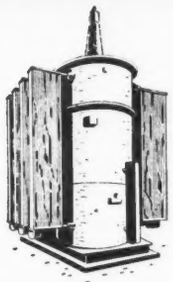
HERE'S WHAT TO LOOK FOR



STEAM ENGINES AND TURBINES . . . obsolete units, parts of broken or worn-out units—pistons, valves, bearings, turbine blades. Also boiler and condenser tubes, grates, and pumps. Even one old piston may provide enough scrap steel for a .50-calibre machine gun.



ELECTRIC GENERATORS . . . bearings, old wiring, housings. Lots of electrical parts are kicking around because someone thought they might be needed "some day." Today's the day! This equipment yields steel, tin, copper, brass, and lead—all sorely needed.



TRANSFORMERS . . . burned-out, broken, discarded. As you review unusable equipment, think not of its original cost, but of the part it can play in speeding production of war materials. Half of every tank, ship, and gun is made of scrap metal.

INSTRUMENTS . . . dial gauges, meter magnets. Nothing is too small to be used for fighting weapons. One broken old instrument may supply enough scrap copper for several hundred rounds of ammunition for an automatic rifle.

AUTOMOTIVE EQUIPMENT and parts . . . crankshafts, cylinder blocks, axles, gears, ignition coils. Battered ashcars, old cranes can serve at the front as parts of a medium tank. There's enough rubber in one old truck tire to provide 20 pairs of boots for paratroopers.

LINE EQUIPMENT . . . metal poles and posts, service transformers, corroded or broken wiring. Sixty feet of electric wire supplies copper for 1,000 37-mm. anti-aircraft shells. Don't burn rubber insulation. Also save old rags, Manila rope, and burlap bags. Get behind the scrap campaign today!

HERE'S WHAT TO DO . . . Appoint one man as Salvage Manager for your organization. Give him authority to *act*—to condemn old equipment, to move material, to collect scrap of all kinds. Have him separate all scrap by type. Then move it promptly through your regular scrap dealers. Don't wait—start rounding up scrap *now*—and keep it moving until the war is won!

THROW YOUR SCRAP INTO THE FIGHT!

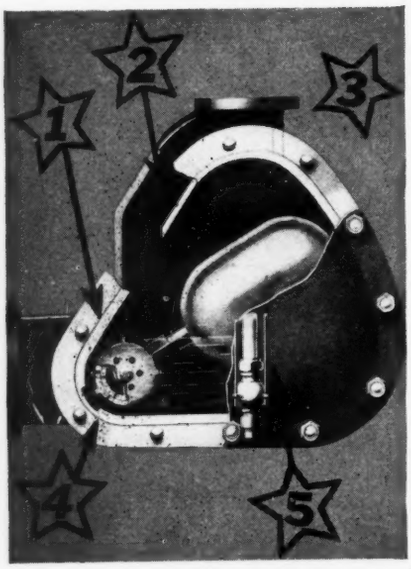
This message approved by Conservation Division

WAR PRODUCTION BOARD

This advertisement paid for by the American Industries Salvage Committee (representing and with funds provided by groups of leading industrial concerns).

5 reasons why COCHRANE MULTIPORT DRAINER

is the IDEAL DRAINER



1. ONLY ONE MOVING ELEMENT, with rotating valve directly attached to float stem, all self contained within an integral housing.
2. TREMENDOUS DISCHARGE CAPACITY is assured by unusually large port areas. Condensate is discharged through a rotating cylindrical valve, as through an orifice, except that there are 6 such orifices in the valve.
3. POSITION HANDLE on outside of body permits closing valve or opening it wide: full opening thus secured serves as an effective blow off.
4. COMPLETE ACCESSIBILITY of valve is provided by removable cover plate, without necessity of disturbing mechanism or piping connections.
5. GAGE-GLASS, with guards and try cock, shows visibly the height of condensate at all times.

Write for a copy of Publication 2925.

COCHRANE CORP., 3106 N. 17th St., Philadelphia, Pa.

Cochrane

D W LLOYD, southwestern district manager of the Westinghouse Air Brake Co, died July 4. He was 52 years of age.

ROBERT F RUNGE, vice-president of SKF Industries, Inc, died July 6. His entire business career was spent with SFK and its predecessor, the Hess-Bright firm. He became vice-president in 1920. Mr Runge had been a trustee of the Drexel Institute since 1935, was vice-president of the Metal Manufacturers Association in 1941, and had been a member of the American Society of Mechanical Engineers for many years.

GEORGE R PATTERSON, an operating engineer at the Webster & Massachusetts power station of the New England Power Association system, died while on duty at that plant some weeks ago. He had been with the Webster & Southbridge division of the Worcester County Electric Co for 15 years.

WILLIAM J GATELY, 60, for about thirty years an operating engineer at the plant of the Boston Navy Yard, died in Boston on June 21. He served four years in the United States Navy before joining the staff of the shore plant.

CHARLES L MEYER, mechanical and sales engineer for the L J Wing Mfg Co, New York, in the metropolitan district for the past 18 years, died suddenly on June 26 at his home in Hollis, L. I. Mr Meyer had long been associated with many prominent firms in the power plant and allied fields, and was an authority on heating and ventilating problems.

HENRY G REIST, 80, retired head of the motor and generating engineering department of the General Electric Co, died July 5, in Schenectady, after a short illness. In 1889, after serving as assistant superintendent of the Harrisburg Foundry & Machine Co in Pennsylvania, he joined the Thomson-Houston Electric Co at Lynn, Mass., which in 1892 was combined with Edison General Electric Co to form the present General Electric Co. In 1894 he took charge of the designs for alternating-current machinery for General Electric. He retired in 1931.

JOHN L BOSSERT, sales engineer for the Ward-Leonard Electric Co, Mount Vernon, N. Y., for the past 17 years, died at his home in that city, Thursday, July 9. Mr Bossert, after a period of teaching at Cooper Union, N. Y., where he obtained his degree in electrical engineering, joined the sales force

THEY ALWAYS DELIVER PALMETTO* PACKING QUICKLY

The war has kept us mighty busy . . . but even so we're proud to say that we've shipped all orders on time. Buy Palmetto and get prompt deliveries, as well as long wear.

WRITE FOR LITERATURE

GREENE, TWEED & COMPANY

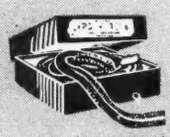
Bronx Blvd. at 238th St., New York, N. Y.

TWISTED

For valve stems; each strand a perfect piece of lubricated packing.

BRAIDED

For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.



*Reg. U. S. Pat. Off.

PALMETTO

for steam, hot water, air. PALCO *for water.*
PELRO *for oils.* CUTNO *for alkalis.*
SUPERCUTNO *(blue asbestos) for acids.*
KLERO *for foods.*

SELF-LUBRICATING **PACKINGS**

why 10 REASONS you can bank on FAIRBANKS

LONG SERVICE LIFE— AN IMPORTANT ADVANTAGE TODAY

Fairbanks Valves are valves that can be depended on for the maximum in years of useful, carefree service. Because they are long lasting, they are of outstanding value as a means of helping to keep plants going and of protecting against "down time". Their long life not only minimizes maintenance but extends the time until replacements become necessary.

In assuring maximum years of service, Fairbanks Valves can be depended on for low cost performance per year of service, because their long-lasting qualities are available without having to pay a premium in price.

Service life of Fairbanks Valves is further extended in Fairbanks Renewable Valves through ability to replace worn parts quickly and easily.

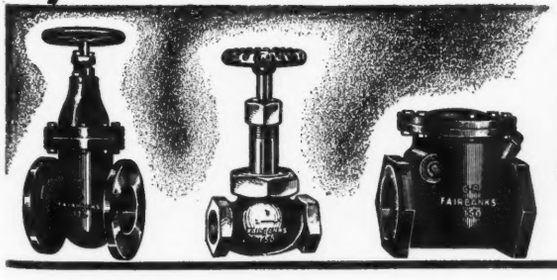
The nearest Fairbanks distributor is ready to assist you. If you don't know him, we'll gladly introduce you. Just ask us.

Have you a copy of the Fairbanks catalog No. 21?

1. Prompt service through conveniently located distributors.
2. Standard and Renewable types for practically every need.
3. Quality in design, materials and workmanship.
4. Uninterrupted service.
5. Low in maintenance cost.
6. Maximum years of service assured.
7. Acclaimed for dependable performance.
8. Nationally accepted by users.
9. Backed by over 50 years' specialized experience.
10. Technical assistance in valve selection.

THE FAIRBANKS COMPANY
397 Lafayette St., New York, N. Y.
Boston, Mass., Pittsburgh, Pa.

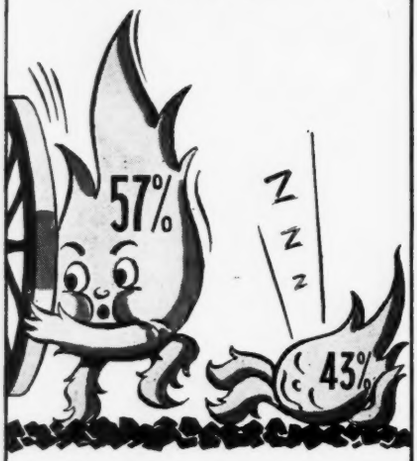
You can bank on...



FAIRBANKS

as the **RIGHT VALVES TO USE**

PUT THAT LOAFER TO WORK, TOO!



At the average power plant, 57% of the fuel does useful work, the other 43% is wasted . . . most of it "up the stack."

CUT FUEL WASTE WITH

Ranarex*

CO_2 INDICATOR and RECORDER

Ranarex, by indicating the CO_2 content of flue gases, leads to increased combustion efficiency, makes fuel deliver *more power per ton.* This sensitive instrument gives readings within 3/10 of 1% CO_2—and it acts within 30 seconds. It requires no skill to operate. And Ranarex is built to stand the strain of today's extra power loads . . . it contains no chemicals or fragile parts to get out of order. Take this first step toward fuel conservation *today:*

GET FREE BOOKLET

For your copy write to: The Permutit Company, Dept. A, 330 West 42nd Street, New York, N. Y. In Canada: Permutit Company of Canada, Ltd. . . . Montreal . . . Toronto . . . Winnipeg . . . Calgary.

*Trademark Reg. U.S. Pat. Off.

product of

PERMUTIT

of Ward-Leonard. He had been in charge of sales engineering work, naval and marine equipment for the company.

ARTHUR GINN, associate sales manager of the New York District Office of Combustion Engineering Co, Inc, passed away suddenly on July 18 at Ogunquit, Me. Mr Ginn joined the sales force of the company in 1918 and represented it in upper New York State.

ARTHUR RADCLIFFE, 60, founder, president and treasurer of the Portland Elevator Co, Boston, Mass., died at a Boston hospital on July 27. He was born in England, and entered the employ of the Portland Co, Portland, Me., as an electrical engineer early in this century, forming the present company in 1916.

FRANK S DUNHAM, Permutit Co sales engineer since 1915, died on July 23 1942. Mr Dunham had been associated with the Permutit Co for approximately 25 years. He retired from the Permutit Co in 1940.

PERSONALS

PHILIP F SMITH, secretary of the Osborn Mfg Co, Cleveland, Ohio, has accepted an appointment as a senior priority specialist in the Special Industrial Machinery Branch of the War Production Board for the duration of the war. Upon his graduation from Dartmouth College in 1923, Mr Smith worked at Osborn as a clerk, and then successively as a salesman, advertising manager and factory manager.

C Granniss Bonner

C GRANNISS BONNER, formerly comptroller and more recently treasurer of the Brunswick-Balke-Collender Co of Chicago, has been elected treasurer of Pomona Pump Co, Pomona, Calif. Mr Bonner relieves Donald C McKenna, vice-president and former treasurer, who

Successful TURBINE operation depends ON PROPER LUBRICATION

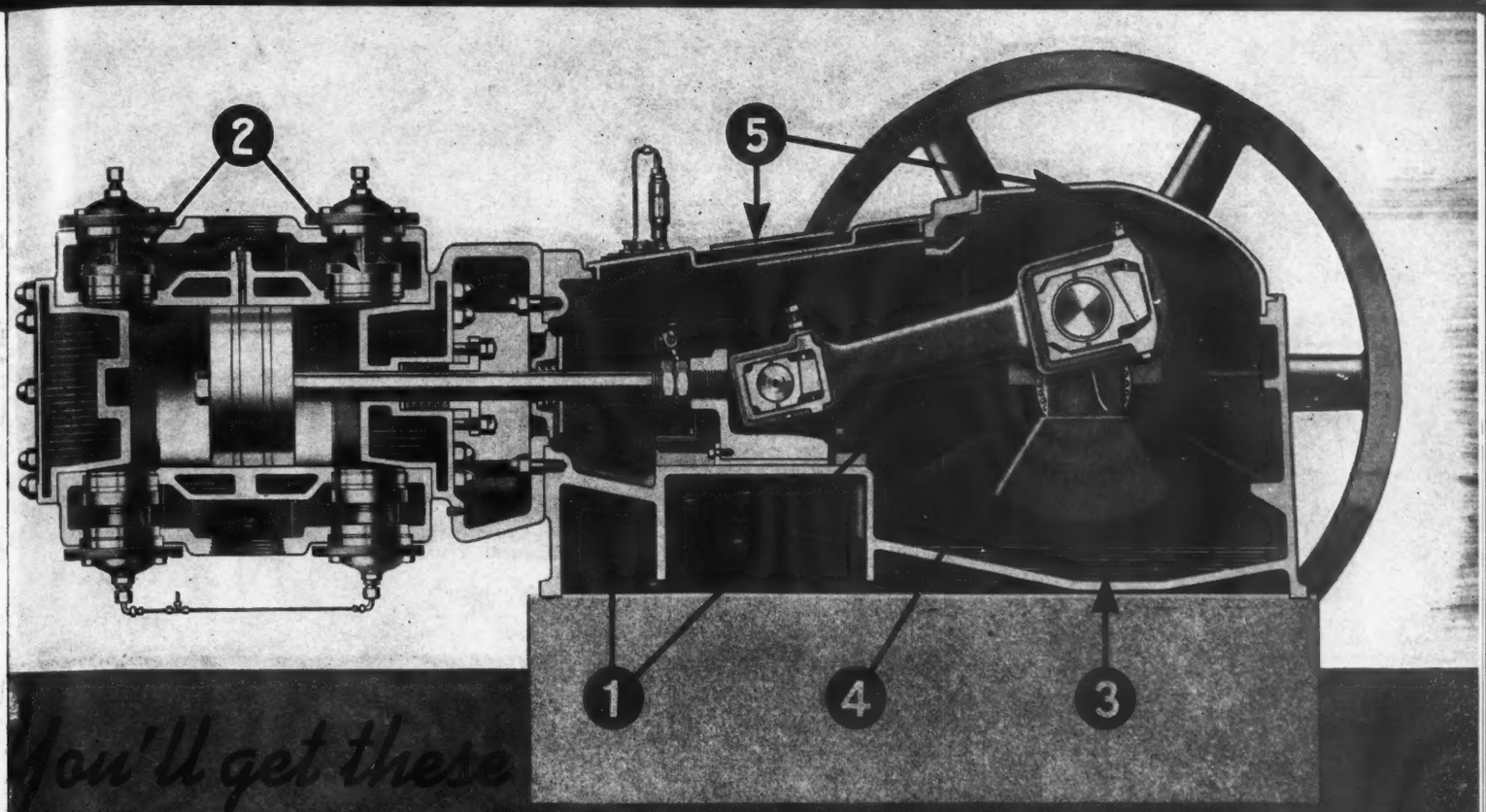
★ Through Modern Oil Purification, proper lubrication for any Turbine becomes a simple problem. Discarding all of the frills and getting back to fundamental principles you will find this basic formula that will provide trouble-free and effective lubrication for any Turbine or Hydro-Electric Generator.

1. *Buy the best grade of oil possible to obtain.*
2. *Maintain this oil in its original lubricating efficiency (regardless of the hours of use) with a Honan-Crane "Continuous" Oil Purifier.*

★ A Honan-Crane "*Continuous*" Oil Purifier gives you Perfect Control over Turbine Oil. All contamination solid or soluble is removed as fast as it is formed.

Honan-Crane "*Continuous*" Oil Purifiers are the product of over twenty years of research and experience and their performance is guaranteed. Write today for Bulletin 300T for complete information on the purification of Turbine and Hydro-Electric Generator Oils.

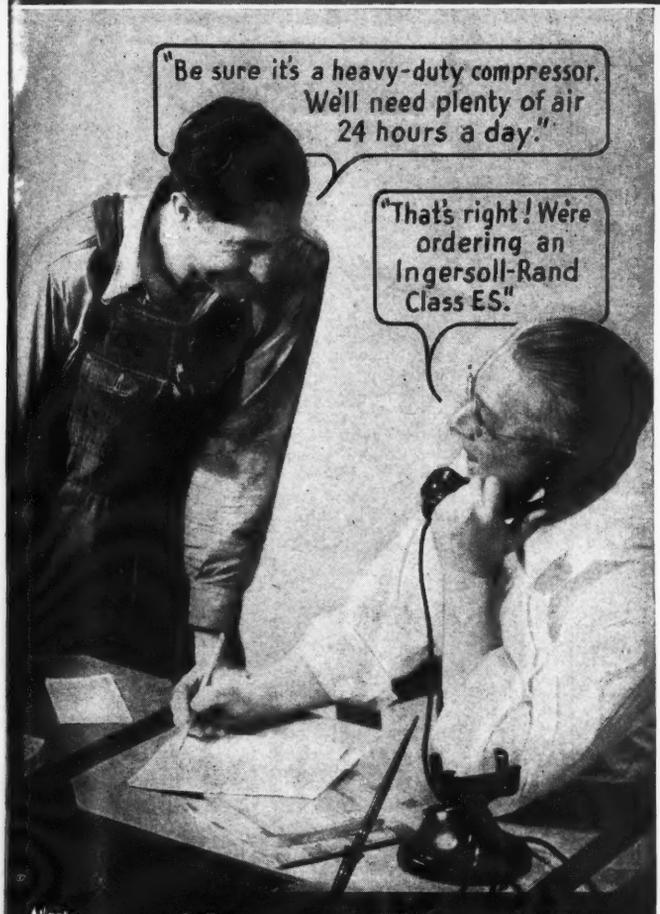
Honan Crane
524 Superior Street
LEBANON, IND.
★
"A YEAR FROM NOW WHAT WILL WE WISH WE HAD DONE TODAY?"



You'll get these

HEAVY-DUTY Features

If you install an INGERSOLL-RAND


"Be sure it's a heavy-duty compressor. We'll need plenty of air 24 hours a day."
"That's right! We're ordering an Ingersoll-Rand Class ES."

Atlanta, Birmingham, Boston, Buffalo, Butte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Duluth, El Paso, Hartford, Houston, Kansas City, Knoxville, Los Angeles, Newark, New Orleans, New York, Philadelphia, Picher, Pittsburgh, Pottsville, Salt Lake City, San Francisco, Scranton, Seattle, St. Louis, Tulsa, Washington

class ES compressor

1 STURDY DESIGN. The "ES" has a die-forged crankshaft and connecting rod, a double-ring piston, and a heavily-ribbed frame, all of which contribute to trouble-free operation.

2 HIGH EFFICIENCY CHANNEL VALVES. Quiet, cushioned Channel Valves are one of the reasons why the Class ES is the most efficient single-stage compressor available today.

3 AUTOMATIC LUBRICATION of running gear parts is simple and reliable. The cylinder is lubricated by a controlled force-feed system.

4 TAPERED ROLLER BEARINGS operate for long periods without adjustment. They are placed in a double row at each end of the crank, with one complete bearing assembly free floating.

5 COMPLETE ACCESSIBILITY is provided by large oil-tight frame covers. These covers are light in weight, and permit quick inspection or adjustment of all running gear parts.

Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

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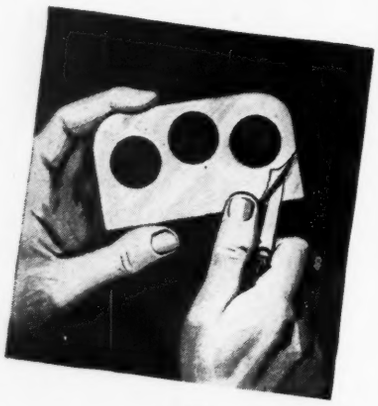
Branches or Distributors in other Principal cities the world over.

INGERSOLL-RAND ALSO BUILDS THE TOOLS THAT USE THE AIR.

save



twice

THE SAME Laminum shim that cuts assembly time 20 to 30 percent again saves *repeatedly* in making precision adjustments . . . for the life-time of the machine!

Laminum shims—.003 or .002 inch brass laminations bonded into a solid unit (easily peeled)—are cut to your specifications.

Stock shim materials are supplied by industrial distributors. Write us for sample and illustrated shim application chart

Laminated Shim Company
Incorporated
61 Union Street Glenbrook, Conn.

it's
LAMINUM
TRADE MARK
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

will devote full time to the increasing production activities of the company's four manufacturing plants.

S H MORTENSEN, engineer in charge of ac design for ten years, has been appointed chief electrical engineer of the Allis-Chalmers Mfg Co plants at West Allis, Cincinnati, Boston and Pittsburgh. Starting at the Allis-Chalmers Norwood works in 1905, Mr Mortensen transferred to Milwaukee as an electrical draftsman three years later. There he successively became design engineer for dc machines, design engineer of rotating synchronous machines, and in 1932 engineer in charge of alternating current design.

WILLIAM H SULLIVAN was appointed to the marine section of the Westinghouse Electric & Mfg Co's Washington staff recently. He joined the Westinghouse Co in 1936, serving his first year on the graduate student training course at East Pittsburgh. Since then he has been a sales correspondent for the steam division at South Philadelphia, a steam specialist for the Middle Atlantic sales district and the Pacific Coast district.

VINCENT C BRENNAN has joined the Union Electric Co of Missouri as executive director of personnel. He has the responsibility of coordinating and directing all activities which affect employee relations.

J M GILFILLAN, for the past two years works manager of the Locke Insulator Corp, Baltimore, Md., was elected vice-president in charge of manufacturing at a recent meeting of the board of directors. In 1920 Mr Gilfillan became associated with the Trumbull Electric Mfg Co as manager of the pottery division at Trenton. He remained there until 1939, when he was transferred to Baltimore as manufacturing assistant.

ARTHUR M HOUSER, engineer of standardization, Crane Co, Chicago, has been appointed consultant in the simplification branch of the Bureau of Industrial Conservation of the War Production Board, Washington, D. C. For nearly thirty years Mr Houser has devoted most of his time to standardization work; in fact, ever since the Boiler Code Committee of the ASME was formed in 1911.

After having completed 46 years of service with General Electric, ARTHUR W HENSHAW, for several years in charge of association relationships in the company, has retired. He joined the General Electric in March, 1896, in the test-

IT *MUST* WORK OR ELSE ~ ~ ~

Because a parachute must be ready *all the time* for an emergency, it has to be made *right.* The same is true of valves . . . especially those located in strategic power plants and production centers.

Ludlow Valves are always ready for emergencies. Throughout American industry, thousands of these rugged valves—many installed years ago—are now meeting the most severe tests, successfully! Operating on the famous double-disc, parallel seat principle, developed and perfected by Ludlow, these sturdy valves work smoothly, close securely—whether in action almost continuously or only on rare occasions. In peace or war, *Ludlow means value in valves.* Send for catalog.

THE LUDLOW VALVE MFG. CO., INC.
TROY, NEW YORK

Construction Features: **Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.**

LUDLOW VALVES

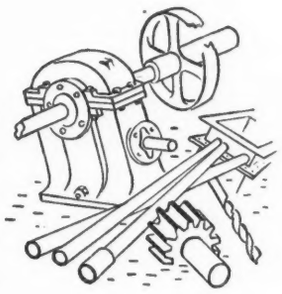
SINCE 1866

WAR PRODUCTION

Won't Get the Steel it Needs

—UNLESS YOU TURN IN ALL YOUR SCRAP!

Your chips, borings, turnings, clippings, punched-out pieces, defective parts, and other scrap that you are turning back to the steel mills are going a long way to help win the war.



other items. It's in your plant or shop—or possibly on the junk heap behind it. There's some in the attic, basement or garage at home, too.

BUT THEY'RE NOT ENOUGH!

To make all the steel needed to keep war production plants up to schedule this year, more scrap iron and steel will be needed—6,000,000 *EXTRA* tons of it. About half of every ton of steel is scrap—whether it be open-hearth or electric furnace steel—the kind most needed for tanks, airplanes, ships, guns, shells.

There's plenty of scrap iron and steel—but it is not being turned back to steel producers. It's in the form of old machinery—broken and worn out dies, tools, jigs, templates, rolls, patterns, molds and fixtures—old gears, line shafting, pulleys, pipe, valves, radiators, water tanks, steel structures, trucks and dozens of

Unless *ALL* this scrap is turned in quickly, war production plants will not get the steel required to make the equipment needed to win the war.

TURN IN YOUR EXTRA SCRAP—every pound that you can find. It may mean another tank—at least another shell which may be the difference between victory or defeat in a battle.

Put this story on your bulletin boards (we'll gladly send reprints). Set a special day or week for digging up scrap. Appoint a competent committee to see that it is done thoroughly. You'll be surprised when you find how much scrap you have. Then call your nearest junk or scrap dealer. He'll pay you for it and send it on to the steel mills.

REPUBLIC STEEL
PRODUCTION FOR VICTORY

This Advertisement Sponsored by

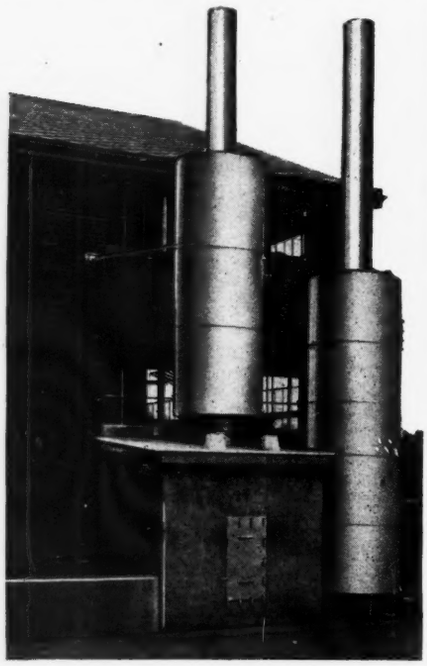
REPUBLIC STEEL CORPORATION

General Offices: Cleveland, Ohio

Berger Manufacturing Division • Culvert Division • Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company • Export Department: Chrysler Building, New York, New York

In Cooperation with the U. S. Government's Salvage Campaign

MAXIM ENGINEERS LIKE TOUGH JOBS



It has been the privilege of Maxim to design and construct over the years a great variety of Silencers for specific duties. Many of them, naturally, were somewhat similar—with the result that it has been possible, with certain modifications, to classify Maxims into several types — now accepted by industrial and marine buyers as standard installations.

This, however, does not alter the fact that Maxim Engineers still like tough jobs . . . and are qualified by long experience to solve all manner of difficult silencing problems.

At the Greenport, L. I., municipal power plant, for instance, Maxim Silencers effectively silence both the intake and exhaust of their new and largest Diesel, a 2 cycle, 1427 h.p. Fairbanks-Morse. This is a tough, continuous service which Maxims are "built to take". They can do similar jobs for you.

The Maxim Silencer Co.

92 Homestead Ave., Hartford, Conn.

MAXIM SILENCERS

ing department, and subsequently was a member of the engineering and manufacturing general departments. In May, 1903, Mr Henshaw was named a commercial engineer in the power and mining department, now known as the industrial department. In Jan. 1925, Mr Henshaw was transferred to the commercial general department, and a few years later was placed in charge of all G-E association relationships.

DAN C HUNGERFORD has resigned as vice-president and director of the Elastic Stop Nut Corp, Union, N. J. He joined the corporation in 1936 as field engineer, and eighteen months later was made chief engineer. In Jan. 1940, he was elected to the board of directors, and in July of the same year was made vice-president in charge of engineering. He was placed in charge of the corporation's sales and advertising activities in 1941.

JULIUS A BERNINGHAUS, general manager of sales of the Organic Chemicals Division of Monsanto Chemical Co, has been promoted to general manager of the division. He succeeds John W Livingston, who resigned to become consulting engineer to the Rubber Reserve Co.

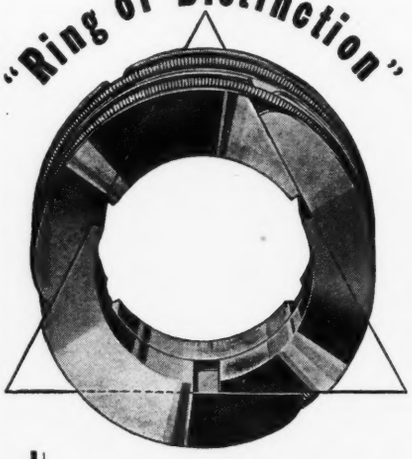
JOHN W LIVINGSTON has joined the Rubber Reserve Co as consulting engineer. Preparatory to becoming active in the Rubber Reserve Co, which is the federal agency dealing with the provision of facilities for synthetic rubber production, Livingston submitted his resignation as a vice-president and member of the board of directors of Monsanto Chemical Co and as a general manager of its organic chemicals division.

HERBERT B REYNOLDS has been promoted to the position of superintendent of motive power of the IRT Division of the New York City Transit System.

RAY G HANSON has been appointed manager of the Westinghouse Mfg & Repair Department at Denver, Colo. Mr Hanson comes to Denver from Milwaukee, Wis., where he managed the manufacturing and repair department for four years.

CHESTER A MOLSBERRY has been made general superintendent of production for the United Illuminating Co, New Haven, Conn. Mr Molsberry has been with the company since 1935, lately general engineer and assistant manager of engineering. Mr Molsberry spent five years with General Electric

"Ring of Distinction"



Install FRANCE Metal Packing for "Round-the-Clock" PRODUCTION

The renewal of ordinary packing every few week or months increases horsepower and production costs.

Minimum friction is encountered with France Metal "Ring of Distinction" Packing. No undue force can be exerted on rods or stems by tightening the stuffing box stud nuts. The rings are free to float in the case that retains them and are held to the rod or stem with a garter spring having minimum tension.

The result is tight "full-floating", trouble-free performance for years. Prompt delivery assured.

FREE

44-page Catalog of useful and valuable information. Write for your free copy of Catalog M-7, with facts on

- Packing Designs for Any Service
- Installation Procedure
- Methods of Lubrication
- Pressures and Temperatures
- Oil Return and Stripping Rings
- Handy Reference Tables

Request France Engineers to analyze your packing requirements. There is a representative close at hand.

THE FRANCE PACKING COMPANY

Tacony, Philadelphia, Penna.

Original FRANCE METAL PACKING

Bartlett·Snow

SKIP HOISTS

—meet every requirement for handling coal, also ashes, limestone and other abrasive materials when the lift is high, capacities large, and a minimum of care and maintenance are desired. Standard and special designs to provide any hourly tonnage capacity. Eng. Bul. No. 83, sent on request, gives full details. The C. O. Bartlett & Snow Co., 6205 Harvard Ave., Cleveland, Ohio.

SUHM
BOILER WATER TREATMENT

Given Credit by new Engineer for

SAVING $400.00 per month in FUEL ALONE!

The new engineer of a Milwaukee metal products manufacturer, in checking his system, found pressures dangerously high, and fuel consumption excessive in relation to the power and steam produced.

He called in a SUHM Engineer to check boiler conditions, and analyze his Raw Boiler Water. The result was fuel savings of over $400.00 PER MONTH . . . And plant efficiency was improved WITHOUT ADDING A SINGLE PIECE OF NEW EQUIPMENT.

Today, with fuel transportation a major problem, it is your PATRIOTIC duty to conserve fuel if possible—to get more work out of present equipment—and to make your equipment last longer!

SUHM Individualized Water Conditioning can help you do this effectively and economically. Return the coupon to start this service working for you.

SUHM SCIENTIFIC WATER TREATMENT for Power or Processing
40 Years of experience solving water problems.

SUHM COMPANY, Inc.
1942-50 S. Kinnickinnic Ave., Milwaukee, Wisconsin

Please send a container so we can return a sample of Raw Boiler Water for ANALYSIS and recommendations — without obligation.

Name.....

Address.....

City.....

State.....

Co, after being graduated from Iowa State College in electrical engineering in 1922, working on test equipment, switchgear, and in central station engineering.

F H Lindus, who has been handling various advertising assignments for the Timken Roller Bearing Co, Canton, Ohio, for the past year, has returned to the sales department of the company's service division and is now located in the San Francisco branch.

Robert B Dale, former head of department of industrial management and mechanical engineering at Pratt Institute, is now associated with the office of Morris & Van Wormer, industrial engineers. Concurrently with his work as an engineering educator, Mr Dale has been engaged in the private practice of consulting engineering in New York since 1925.

Robert H Morse, Jr, who has been branch manager successively of Fairbanks, Morse & Co's offices at Cincinnati, Dallas and Boston, has recently taken his position as assistant sales manager with Mr A C Dodge, vice-president and sales manager of Fairbanks, Morse & Co, Chicago, Ill.

R J Hearn has been appointed assistant manager of the Boston district office of the Crocker-Wheeler Electric Mfg Co. An electrical engineering graduate of the University of Notre Dame, Mr Hearn joined Crocker-Wheeler 2½ years ago as a field engineer. He was formerly employed by Allis-Chalmers Mfg Co as a sales and service engineer in Milwaukee, Cleveland and Boston.

BUSINESS ITEMS

Chain Belt Co, Milwaukee, Wis, announces the appointment of the Industrial Equipment Co, 1301-59th St, Oakland, Calif., as distributor of the company products. The Sanford Tractor & Equipment Co, 500 East 4th St, Reno, Nev., has also been named as a distributor.

Cutler-Hammer, Inc, Milwaukee, announces several personnel changes and additions. R Keeler has been added to the staff of the Philadelphia district office, J E McSorley has joined the staff of the Cincinnati district office, and J R Darnall is now connected with the New York district office of the company.

American Foundry & Equipment Co, Mishawaka, Ind., announces the

TIME SAVED ON POWER PLANT MAINTENANCE JOBS Helps Nation's War Effort

For Example:

28 SUCCESSFUL WAYS TO SPEED MAINTENANCE!

Concisely described in the NEW Oakite Power Plant Maintenance DIGEST are 28 essential, commonly recurring jobs where specialized, fast-working Oakite cleaning is (1) shortening equipment down-time, (2) conserving man-hours, and (3) saving money for power plants, central stations and public service companies across the Nation.

Each job is one on which performance-proved Oakite cleaning can help you, too, SPEED-UP work. On each is given, in data sheet form for quick reference, the Oakite material used, method followed, time saved, and other money-saving advantages obtained.

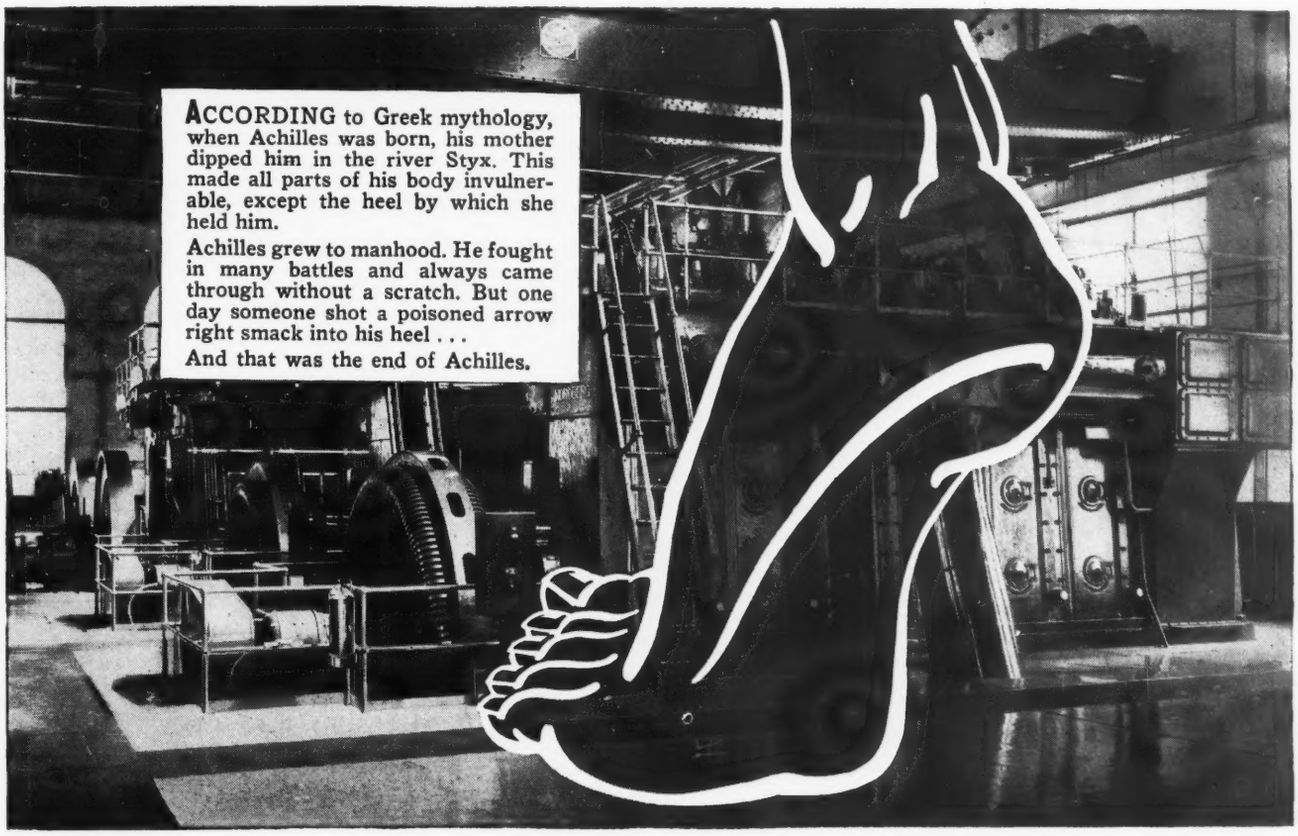
Send For This Helpful FREE DIGEST Today!

Whatever the job . . . cleaning lube oil coolers, de-scaling Diesel engine cooling systems, stripping transformer radiators, washing floors . . . this Digest will give you the RIGHT ANSWER for handling the work on the fast, easy, low-cost basis you want. YOUR copy is FREE . . . write for it TODAY!

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Representatives in All Principal Cities of the United States and Canada.

OAKITE *Specialized cleaning*
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Remember the story of Achilles' Heel?


ACCORDING to Greek mythology, when Achilles was born, his mother dipped him in the river Styx. This made all parts of his body invulnerable, except the heel by which she held him.
Achilles grew to manhood. He fought in many battles and always came through without a scratch. But one day someone shot a poisoned arrow right smack into his heel . . .
And that was the end of Achilles.

There's a moral in it for every Diesel Engine Owner!

Your Diesel engine has its own Achilles' heel.

It's the need for proper lubrication.

Without proper lubrication your Diesel is vulnerable. A burnt-out bearing may hold up production indefinitely. That means precious man-hours lost, schedules delayed, and a costly repair bill for you to pay.

These days, with quotas going up . . . with engines driving longer and harder than ever . . . and with Diesel parts almost impossible to replace — you cannot afford to take chances with makeshift lubrication. *Continuous, efficient operation demands a lubrication plan designed for your particular job!*

That's where a Cities Service lubrication engineer can be of great help to you. He knows what you're up against, and he has the necessary "know-how" and special instruments to tackle the job scientifically.

There's no charge for this friendly consultation. Simply phone or write the office nearest you.

An informative booklet, "Diesel Engine Lubrication," is yours for the asking. Just check the space indicated.

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.
or any of the following offices:
CHICAGO . CLEVELAND . ST. PAUL
KANSAS CITY . BOSTON . TORONTO
or to
ARKANSAS FUEL OIL COMPANY
SHREVEPORT . ATLANTA . BIRMINGHAM

Please send me your booklet, "Diesel Engine Lubrication." ☐ P. R.

Name_____

Firm Name_____

Address_____

City_____ State_____

A LUBRICANT FOR EVERY INDUSTRIAL NEED

PEPHAPS THIS
STANDARD
VIKING
PUMP
WILL DO THE WORK

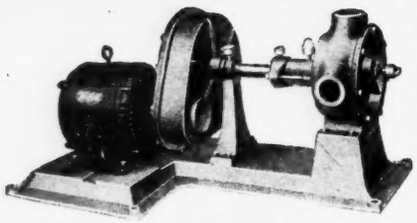


Fig. 12—Standard Gear-Driven Pump

Valuable time in securing materials and in production often can be saved when you order a "standard" Viking Rotary Pump, instead of a "special". In addition, you help conserve vital steels and alloys.

Consult your nearest Viking representative, or the factory, in regard to your War-time rotary pump problems. Suggestions may be offered to speed up delivery time many weeks. Also send for *free* 44-page catalog showing many standard models and sizes of Viking Rotary Pumps . . . Write today.

WHEN ORDERING PUMPS OR PARTS, PLEASE GIVE US YOUR PRIORITY RATING AND ALLOCATION SYMBOL. Be sure to obtain the highest rating possible. Check up to see if recent priority changes have improved your rating.

★

VIKING
PUMP COMPANY
CEDAR FALLS, IOWA

appointment of David Logan and Frank W Pedrotty as district sales representatives.

THE BUDA CO announces personnel changes. Frank M Boylan has joined the company as a field representative in the industrial division. William T Sanford has been made service manager of the railroad division of the company.

Following the passing of former President Morris S Towson on March 17, the newly-elected officers of the ELWELL-PARKER ELECTRIC CO, Cleveland, Ohio, are S K Towson, president and general manager; W A Meddick, vice-president.

YORK ICE MACHINERY CORP, York, Pa., announces the following personnel changes: James C Tweedell, export manager of the company, has been appointed general sales manager for the duration, succeeding John R Hertzler, who will undertake a special assignment in a civilian capacity with the Army & Navy munitions board in Washington. Ralph B Meisenhelder, assistant to the president of the corporation, has been appointed director of war contract progress. William S. Shipley, chairman of the board, has been appointed director and vice-chairman of the War Production Board's Small Plants Corp. John Carr has been appointed export sales manager, with headquarters in the executive offices at York, Pa.

The board of directors of PITTSBURGH PIPING & EQUIPMENT CO, Pittsburgh, Pa., announces the election of the following officers: Charles R Rall, chairman of the board; L K Hamilton, president; Karl F Tiegel, vice-president; Joseph G Gardiner, secretary; Charles R Rall, treasurer; G S Larsen, chief engineer, F J Hays, assistant treasurer.

The JOHN C DOLPH CO announces the appointment of the R A Staff Co of 1213 W Third St, Cleveland, as their exclusive representative in the Cleveland area.

The boards of directors of the operating companies of PUBLIC SERVICE CORP OF NEW JERSEY approved recently the following changes in organization: Vice-President Robert A Zachary to be vice-president in charge of public relations. The office of director of publicity to be disassociated from the office of vice-president in charge of public relations. Walter F Allen will be in charge of the publicity and advertising de-

A GOOD
Pillow Block

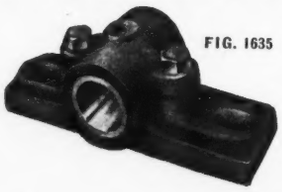


FIG. 1635

"STANDCO" PILLOW BLOCKS

The "STANDCO" Pillow Block is accurately and sturdily built. The babbitted bearing surfaces are highly finished, and both faces are *machined*. Complete range of sizes.

"HALLOWELL" STEEL SHAFT COLLARS

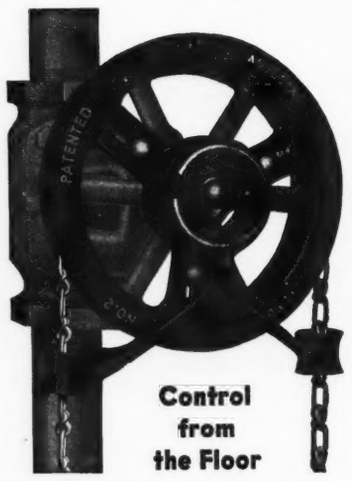
Precision machined, nicely finished, separately wrapped and fitted with the famous "UNBRAKO" Self-Locking Set Screw—in all desired sizes.

FIG. 1432
PATENTED

Write for Details

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 577
— *Branches* —
BOSTON • DETROIT • INDIANAPOLIS
CHICAGO • ST. LOUIS • SAN FRANCISCO

Make Your Overhead Valves SAFE And Easy to Reach---



Control from the Floor

With the Babbitt Rim for Valves you eliminate danger and banish the step-ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

America is now thoroughly awake to the seriousness of what lies ahead. There is a definite realization that we can lose this war if we do not take advantage of every one of our national resources.

The sources of virgin raw materials, -- ore mines, coal mines, mines from which alloying materials are produced -- are being drawn upon to their limit. But now the steel industry, in order to produce the necessary steel for tanks, guns, planes, ships, shells, bombs, machines and other vital war material, needs 6,000,000 tons of scrap in addition to the regularly available supply to achieve its goal.

The extra supply of iron and steel scrap is largely beyond the control of our industry -- it is in the hands of more than a hundred million Americans. In order that ultimate Victory may be assured, every individual must adopt an objective, fact-facing attitude and pledge himself to help in the mobilization of every pound of iron and steel scrap and make it available, through regular channels, in order that it can be converted into prime steel.

This Advertisement Sponsored By

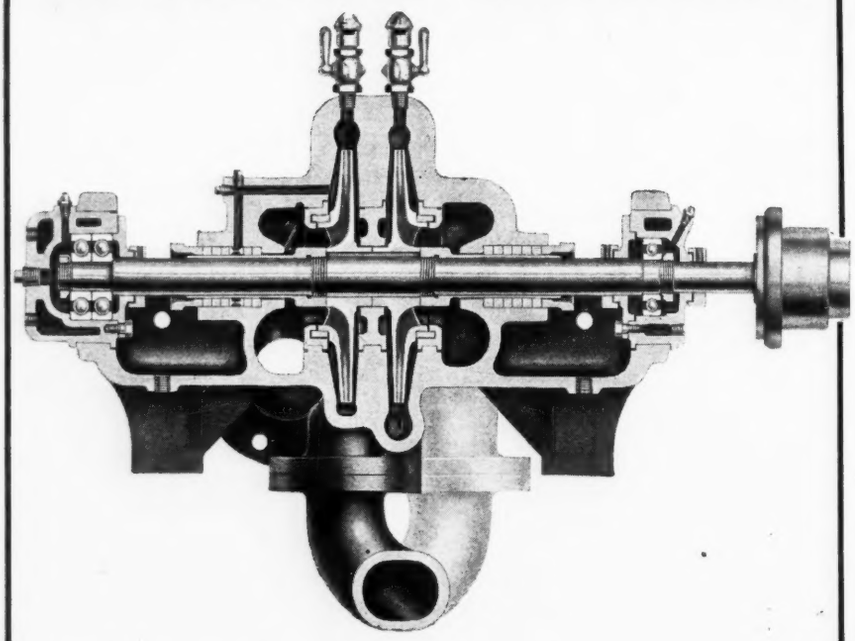
THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO

In Cooperation With The U.S. Government Salvage Campaign

Let's go into

DETAILS about WARREN

TWO STAGE PUMP CONSTRUCTION



To understand why Warren Pumps can work 24 hours a day, seven days a week, without break-downs and at low operating costs, you should know some of the principles of Warren Pump construction.

For instance, take Warren Two Stage Volute Centrifugal Pumps:

CASING: Horizontally split, permitting easy inspection or repairs without disturbing alignment or pipe connections.

SHAFT: Ample diameter to safety transmit required power without undue bending or twisting.

CASE RINGS: Nozzle type, held in place by tongue and grove lock joint. This construction maintains parallel clearances.

CENTER SECTION: Reduces interstage leakage; protects casing from wear.

BEARINGS: Oversize . . . . produces long life and greater protection against overloads.

GLANDS: Split type, easily removable facilitating ease in repacking.

TESTING: All pumps are tested under actual working conditions and at temperature of fluid handled.

LAST but not LEAST: . . . . Warren Pumps are *built to fit the job* . . . YOUR JOB!

WARREN PUMPS

Warren Steam Pump Co., Inc., Warren, Mass.

partment, continuing as director of publicity. The position of executive assistant, Essex Division, was created. Russell H Williams was appointed to that position. He will report to the vice-president in charge of public relations and will be a member of the public relations committee. Charles C. Harbinson will remain as assistant in the office of the vice-president in charge of public relations.

The following companies, according to information received this month, have been presented with the Army and Navy "E" Award, for excellence of performance in the fulfillment of naval ordnance contracts:

Foster-Wheeler Corp — Award presented to Carteret plant recently.

Handy & Harman—Presented joint Army-Navy Production Award, Aug. 15.

General Motors Corp—Award presented to Cleveland Diesel Engine Division on July 2.

Jenkins Bros. — Award presented August 19.

Westinghouse Electric & Mfg Co—Five plants presented joint Army-Navy Award: Steam Div, East Pittsburgh Div, Transformer Div, two District Mfg & Repair Plants.

From information received during the past month, POWER *here presents a brief summary of power men who have left their business positions to enter the armed services:*

W H Long, member of the sales promotion and advertising department of the York Ice Machinery Corp, to Ensign, United States Naval Reserve.

F D Crowther, lighting division sales manager of the General Electric Co, Schenectady, N. Y., to captain in the United States Signal Corps.

Conserve Copper
WITH ROCKBESTOS

Look into the copper-saving possibilities of Rockbestos wires and cables before you lay out your next wiring job. Their heatproof and fireproof insulation gives you greater carrying capacity, size for size, because it can be run hotter (Type AI, 125°C.-257°F., Type AVA, 110°C.-230°F., 1940 Nat. Elec. Code page 286). This means that in many installations you can use smaller conductors safely and save vital copper.

And you'll save more than copper because Rockbestos wires and cables are built to stand up *permanently* under severe operating conditions—heat—moisture—oil—grease—corrosive fumes—fire. They won't bake brittle, bloom, burn or rot, but they will eliminate a lot of failures, wire-fires, and resulting production losses.

1½ Tons of Copper Saved on a Single Job

Here's an example of the copper-saving possibilities of Rockbestos Power Cables. A defense plant job needed 4000 feet of cable for a 750 ampere load—cables to be installed open on insulators. The use of 700,000 CM Type SBW cable (N. E. C. rating 760 amps.) had been considered. We suggested 450,000 CM Rockbestos All-Asbestos Power Cable, N. E. C. Type AI, rated at 755 amps., because of its higher permissible operating temperature --- *which would save 1½ tons of copper!*

Then, for a better job, we recommended 500,000 CM Rockbestos A. V. C. Power Cable, N. E. C. Type AVA rated at 765 amps., installed on messenger to eliminate the excessive reactance drop of open wiring—*which still saved almost 1½ tons of copper* over the use of Type SBW.

Our engineers may be able to analyze your job with similar results.

INSULATION DETAILS

Rockbestos A. V. C. 600 Volt Power Cable — shown above—(Underwriters' and National Electrical Code, Type AVA) has a maximum operating temperature of 110°C. (230°F.) and the current-carrying capacities listed in pages 301 and 302 of the Code. Its *permanent insulation* consists of:

1

Thick, durable, impregnated asbestos braid that insures positive protection against heat, flame, moisture, oil, grease and corrosive fumes.

2

Felted asbestos which serves as a heat-barrier against high ambient temperatures.

3

High-dielectric varnished cambric, protected from heat, flame and oxidation by two felted asbestos walls, gives added moisture resistance.

4

Inner felted asbestos wall which is unaffected by conductor-heating overloads and won't burn when exposed to copper-melting arcs.

Other Rockbestos constructions—with similar insulation—include Control and Motor Lead Cables, Boiler Room and Lighting Wire.

When Ordering give end-use classification and authorized preference rating. For information write to the nearest branch office listed below or Rockbestos Products Corporation, 863 Nicoll Street, New Haven, Connecticut.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

420 cu. ft. of air from 23.4 sq. ft. floor area . . . . with integral cooling

. . . offered by Schramm in a complete "BUILT-IN" MOTOR DRIVE COMPRESSOR UNIT

More air in a hurry—that's what Schramm Compressors supply in small space, when and where needed and without special time-consuming foundations, assembly or piping.

Note the compactness of the Schramm unit shown here in comparison with a man of average size. Both motor and compressor are mounted as a single unit on a sub-base that serves as a foundation. Such a unit can be installed wherever current is available. Floor space for the 420 cu. ft. model shown is only 90"x37½".

This compactness in design is due in large measure to vertical cylinders, cast en-bloc and the absence of overhanging or projecting parts.

Integral water-cooling is another feature. If you were to "Watch the Thermometer" on any Schramm water-cooled compressor you would find no wide variation between the temperatures on the different sides of the cylinder heads, an advantage that eliminates unequal expansion and contraction.

Distortion of cylinders and heads is avoided and longer service life asssured.

Schramm Water-Cooled Air Compressors can be depended on for outstanding performance and satisfactory cooling under all temperature conditions, summer or winter, because water jackets completely surrounding cylinders and heads assure uniform cooling.

Write at once for detailed specifications of Schramm Stationary Air Compressors in capacities from 50 to 600 cu. ft. of displacement.

SEND FOR 12 PAGE CATALOG 42-S

FREE

SCHRAMM, THE COMPRESSOR PEOPLE
WEST CHESTER, PA.

SCHRAMM Air Compressors

Grand Coulee Generator Gets Preliminary Run

Grand Coulee's third 108,000-kw generator began its trial run March 21 and was scheduled to be ready for commercial service within a month of that date. It brings the capacity of the station to 344,000 kw and marks the conclusion of the first phase of power installation.

Erection work will start again in the fall when parts for a second order of three main units will begin arriving from the Westinghouse East Pittsburgh factory. The first of those machines is scheduled for operation in July 1943, with all nine units in this station set for complete installation by Sept, 1944. A second power station which will also house nine units is being erected at the opposite end of the dam from the present station.

Power supply for the Bonneville Coulee network has been increased further in April when Unit No. 6 at Bonneville, a 54,000-kw machine, is ready for power production. Units 7-10 are scheduled for operation by the end of 1943, bringing Bonneville to its ultimate capacity of 520,000 kw.

Three New Aluminum Plants Now Producing

Three new Government-owned aluminum plants had started operations by May 30, a fourth began production according to schedule, early in June, and the entire first expansion program of seven plants will be in production by August 1, A H Bunker, chief, aluminum and magnesium branch, announced.

All seven plants will be completed ahead of schedule, he said. The first two were finished in 6 months, as compared to a normal building time of 11 months. The plants will get into full production from 60 to 120 days after completion, depending upon size.

War Plants Use Million-Volt X-Ray Units

More than 40 portable million-volt X-ray units are now in actual operation or soon to be placed in service in industrial plants making important war material, according to a paper presented by W F Westendorp and Dr Ernest E Charlton, General Electric Co, at the June meeting of ASTM.

A year ago only one such unit was in use, although several fixed outfits had been placed in hospitals for cancer therapy. Radiographing parts made of

3 Million Tons of iron and steel scrap are wanted every month . . . Are you doing your part to help America win her battle of production?

CONSERVATION AUTHORITIES RECOMMEND THESE 8 STEPS TO GET IN THE SCRAP

1 Put some one individual in charge of scrap in all departments of your business and GIVE HIM AUTHORITY TO ACT.

2 Comb the plant and yards for dormant scrap, abandoned equipment, old boilers, pipe, moulds, obsolete dies and parts, material now being destroyed which has salvage value.

3 Survey all plant equipment, particularly idle standby or discarded machines, with a view to applying or converting them to useful production.

4 SEGREGATION:
Identify, classify and segregate scrap and supervise its handling to avoid contamination. This will increase its value.

Provide separate containers, clearly marked, tor each class of scrap material.

Repair or rework worn or broken cutting tools Keep unusable small pieces and turnings segregated. Even high speed steel grinding dust is valuable.

Dismantle discarded equipment promptly into its components—electrical, fastenings, lumber, etc.—so that these parts may be utilized or scrapped.

Sort blanks, short ends, cut-downs, clippings, etc., for possible reuse for smaller parts made in the same or other departments.

Recover and reclaim used cutting oils, lubricants, surplus paints and spray finishes.

Sort sweepings and miscellaneous waste to recover scrap values.

5 Constant reminders in the form of posters, illustrations of right and wrong methods, pay envelope enclosures, house organ publicity, etc., are potent aids to the conservation program.

6 Release for scrap, obsolete engravings, electrotypes, and standing types for catalogs, forms and advertising material.

7 Inspect all refuse to detect avoidable waste and excessive rejections. Educate production executives to correct such conditions at the source.

8 For information and assistance on special phases of conservation and salvage communicate with Industrial Salvage Section, Conservation Division, War Production Board, 9th Floor, Washington Gas Light Building, Washington, D. C., or with nearest regional office

The metallurgical experience of our technical staff is available to aid you in these and other technical phases of metal salvage.

KEEP SCRAP MOVING INTO WAR PRODUCTION!

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

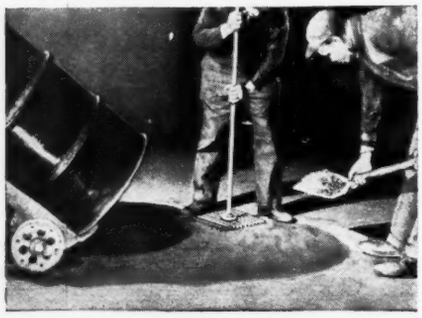
Unseen but Effective

The DE LAVAL IMO PUMP

within the oil reservoir here shown is driven by the 7200 rpm. motor to supply pressure oil for hydraulic controls. The simplicity, compactness and lightness of the IMO pump, as well as its high efficiency, recommend it for many uses where rotary pumps are desirable but have heretofore proved too cumbersome. The IMO is also used as an hydraulic motor.

Ask for Publication I-97

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey



PATCH FLOORS

WHILE TRAFFIC ROLLS

No traffic interruptions when you patch broken concrete with durable INSTANT-USE. Material comes ready mixed. Simply shovel into hole, tamp and run traffic over immediately—without waiting. Bonds tight to old concrete. Makes smooth, solid, lasting patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER

MAKE THIS TEST!

FLEXROCK CO.
2377 Manning St., Philadelphia, Pa.

Please send me complete INSTANT-USE information . . . details of FREE TRIAL OFFER —no obligation.

Name .....
Company .....
Address .....

steel and other metals, ranging up to 8 in. thick, clearly reveals hidden defects which may be chipped out and repaired. The portable unit, completely enclosed in a metal tank 3 ft in diameter, 4 ft in length and weighing 1500 lb, can be handled easily and positioned over castings weighing many tons which would be difficult to set up for radiographing by a fixed unit.

Three factors make possible a compact and lightweight unit: the multisection X-ray tube, the new "resonance" transformer, and the use of gas for insulation. Mr Westendorp said that some million-volt X-ray units have been in daily use for nearly a year and show no signs of electrical instability or mechanical deterioration. He predicted that external mechanical abuse may be the chief factor in determining the useful life of the tubes rather than electrical stresses or vacuum conditions inside the glass and metal envelope.

Organic Chemical Helps Conserve Vital Tin

Tens of thousands of pounds of tin a year will be saved by a new organic chemical announced by the Merrimac Division of Monsanto Chemical Company.

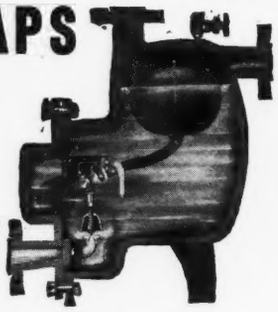
Known as DP Solution, the material, when added in small amount to clear lacquers, alcoholic shellacs and nitrocellulose solutions such as pyroxylin and collodion, prevents corrosion of iron by these products, allowing them to be shipped in plain steel drums instead of the tin-lined containers heretofore required. Use of the new material also has proved to be more economical than tin-lining of containers, even if sufficient tin were available.

Two pounds of tin ordinarily are used to coat the interior of a single 55-gal drum of the type used for industrial shipments of lacquers. With ordinary use, such tin-lined drums have a life of about three years, but the increased production of lacquers for war industry has meant that available containers must be re-used more frequently with the result that the life-span of those now in service will be considerably lessened.

Diesel-Electric Floating Power Plants

Floating power plants for emergency use in case of breakdown of existing power facilities or to supplement such facilities to meet unprecedented demands are now realities, according to Gordon Lefebvre, vice-president and

NICHOLSON
Weight-Operated
TRAPS



Keep Steam Units at TOP Efficiency

STOPS the costly loss of live steam due to re-evaporation of condensate under super heat conditions . . . valve always wide open or fully closed. Dependable performance and long life assured by quick snap action and non-collapsible float. Built for all pressures up to 1500 lbs. Made in sizes from ½" to 2". Write for catalog No. 941.

W. H. NICHOLSON & CO.
125 OREGON ST., WILKES-BARRE, PA

Piston and Weight Operated Steam Traps, Industrial Thermostatic Traps, Compressed Air Traps, Floats, Couplings, Valves, etc.

BLAST GATE HEADQUARTERS

Threaded Butterfly Type

ROCKWELL Blast Gates are better designed, combine light weight with strength and are carefully machined and tested. They close airtight and have graduated dials for accurate setting and resetting.

Made in all types—slide, kwikleen, butterfly and wafer, with lever, handwheel and chain wheel control — there's a Rockwell Blast Gate for every requirement. Write for catalog 4020, W. S. Rockwell Co., 50 Church Street, New York.

★ Rockwell ★
BLAST GATES

If you have anything to do with boilers or industrial furnaces

HERE IS SOME INFORMATION TO HELP YOU

All over America today engineers and plant men are making every effort to operate their equipment at capacity to aid in the war effort.

To assist these operators get more and more from the plant equipment they already have, the A. P. Green Fire Brick Company offers helpful suggestions in the form of bulletins, charts, booklets and folders telling about the economical use of refractory specialty products—materials that are doing an outstanding job in helping keep plants going at capacity—and which are available without priorities from local warehouse stocks near you.

CHECK COUPON BELOW FOR YOUR FREE COPIES

STABILIZED PLASTIC LININGS

P-3 — A sure cure for bulging side walls. Eight pages of information on refractory linings for HRT boilers. Drawings and photographs show advantages and results.

CASTABLE REFRACTORY

P-12 — In thousands of plants all over the country KAST-SET is solving countless problems. This interesting folder illustrates many of the uses for this handy mix-and-pour refractory.

MAKE YOUR OWN REFRACTORY SHAPES

RP-2 — This bulletin tells how long delays and delivery promises on factory-made special tile are avoided by using KAST-SET and Plastic Fire Brick.

SUPER-PLASTIC

RP-1 — The four essential qualities of super duty fireclay brick contained in SUPER-PLASTIC are described in a series of interesting bulletins. Describes A.S.T.M. tests.

INDUSTRIAL INSULATION

P-42 — Insulation is recognized as essential to the close temperature control required by many modern industrial processes and the efficient and economical operation of practically all industries. Folder tells why 'SAIR-LITE insulations offer new advantages in materials for the reduction of fuel and labor costs.

REFRACTORY MAINTENANCE

P-46 — How to re-condition your furnace walls. This informative folder shows how spalled or worn away linings can be kept in constant repair — at low cost — with GREENCOTE. Photographs show actual results.

ESTIMATING MADE EASIER

P-39 — Bulletin gives valuable data for use in estimating quantities of refractories for proper application. Includes unit quantities for figuring fire brick, mortars, plastics, coatings and castables as well as useful formulas.

PLASTIC FIRE BRICK

N-140 — The story of plastic construction told with actual installation photographs. Shows the simple steps in the installation of a plastic wall.

To further help with your battle of production we offer personal assistance from A. P. Green engineers who will work with you to devise means of getting longer life and greater service from what you already have.

A. P. Green FIRE BRICK COMPANY
MEXICO, MISSOURI

the First Name in Refractories

Fireclay Brick . . . Super Duty Brick . . . High Alumina Brick . . . Special Refractory Tile . . . Insulating Fire Brick . . . Plastic Fire Brick . . . Mortars . . . Maintenance Coating Materials . . . Refractory Castables . . . Oil Burner Combustion Chambers . . . Industrial Insulations

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MEXICO, MISSOURI

Please send me the free aids checked below:

☐ P-3 ☐ RP-2 ☐ P-42 ☐ P-39
☐ P-12 ☐ RP-1 ☐ P-46 ☐ N-140

Name.....

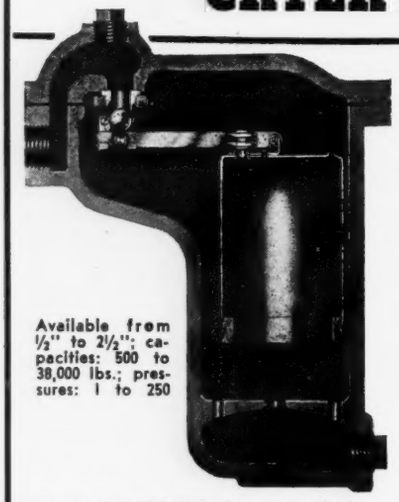
Title.....

Company.....

Address.....

Get more power from existing equipment—*by installing*

CRYER STEAM TRAPS



Available from ½" to 2½"; capacities: 500 to 38,000 lbs.; pressures: 1 to 250

DO IT NOW!

If you need increased effective boiler capacity quickly, take a look around your plant and spot the wasteful, leaking, dribbling steam traps. Replace these trouble-makers with CRYERS and you'll not only stop leaks but reduce steam consumption thereby getting in effect more steaming capacity.

Now's the time to do this kind of trouble shooting—now when war loads demand more steam and when wheels must be kept turning with minimum time out for maintenance of steam lines and when critical fuels must be conserved.

CRYER STEAM TRAPS are designed and built to stop waste and assures better steam distribution by eliminating air binding, slow venting and dribbling. They are positive and quick in action, easily installed, readily accessible, long-lived and of high capacity. Furthermore they are guaranteed to discharge condensate at rated capacities and perform satisfactorily within the limits of pressure and capacity.

Put CRYERS to work immediately—
they're guaranteed for performance

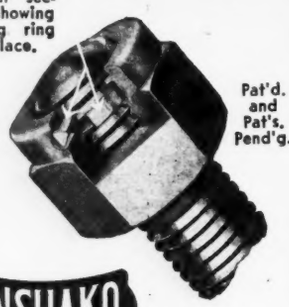
SEND AT ONCE FOR DETAILS.

We carry all sizes of traps and repair parts for the line formerly known as J-M Ball Steam Traps.

CRYER TRAP AND VALVE CO., INC.
MANUFACTURERS OF STEAM SPECIALTIES FOR MORE THAN 40 YEARS.
366 MADISON AVE. NEW YORK, N. Y.

Won't work loose!

Cut-out section showing locking ring in place.



Pat'd. and Pat's. Pend'g.

UNSHAKO

Reg. U. S. Pat. Off.

SELF-LOCKING NUT

Play safe—use "UNSHAKO" Self-Locking Nuts on engines, generators, pumps, stokers, conveyors, etc. The *built-in* self-energizing *locking ring* works on the principle of a brake-hand—prevents loosening regardless of vibration or jarring. Entirely self-contained—no pins or washers to mislay. Write for details.

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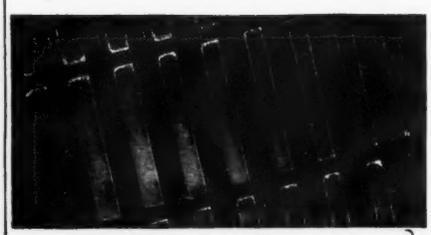
SAFE TRACTION *with* BATESGRATES

ELECTRICALLY PRESSURE WELDED

Non-slip, sharp top edge, self-cleaning cross bars like the ridge of a roof give you the maximum in safe traction. Other features your Batesgrate dollars buy are —maximum open area for light and air— no grooves or rough burned metal to catch grease or dirt—fillet weld, the strongest type—no cracks, joints, or crevices, therefore, easily maintained—smooth, clean appearance. Get all the important details from Catalog No. 937—Write today.



WHEN YOU NEED GRATES

Specify BATES

FOR LONG-TIME ECONOMY

WALTER BATES COMPANY
208 S. LA SALLE ST., CHICAGO, ILL.

general manager, The Cooper-Bessemer Corp.

"It is possible," Lefebvre said, "to easily provide floating power plants, assigned to strategic areas, that could be quickly towed to affected districts and supply electric power until land facilities were restored. Such marine power plants could be mounted on a barge of simple construction. Driven by modern diesel engines, they would cost much less than land plants of equal power-production possibilities."

With these floating diesel plants it is possible to generate power for less than 0.50 cents per kwhr, according to Mr Lefebvre. "Floating power plants are not still in the 'dream' stage," he said. "A very successful floating diesel power plant, consisting of 10 diesel engines of 100 hp each, set five in a row on each side of a line shaft which runs down the center of the plant, is now in use on the Mississippi River. Any engine in the group can be disconnected from the shaft when desired. In this particular case, the power furnished was for dredging but it could be just as easily converted to power needs in case of disaster to a land power plant."

Charles A Coffin Award to San Diego Gas and Electric

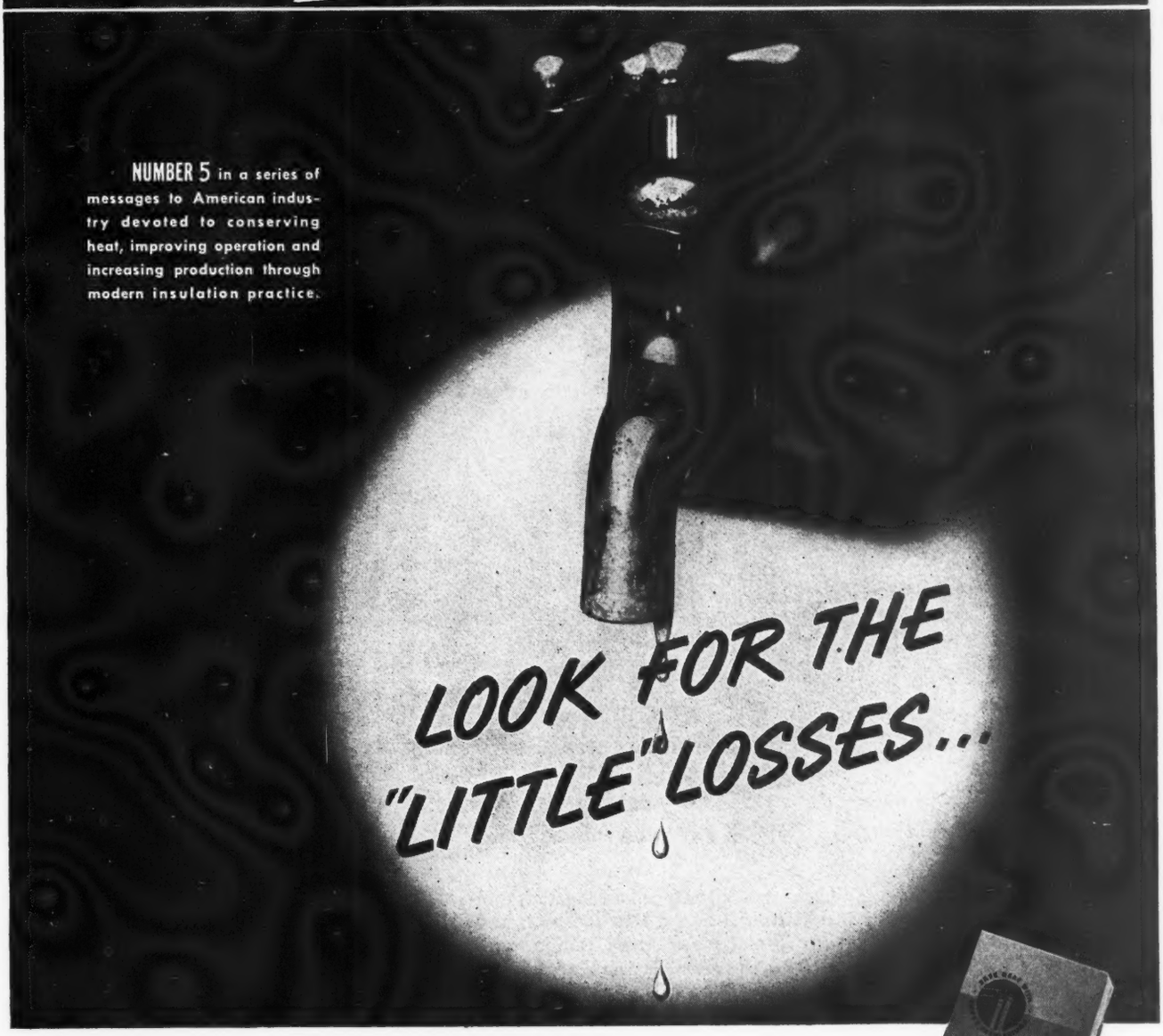
The San Diego Gas and Electric Co, a utility serving a population of 351,000 in 67 communities in and around San Diego, received the Charles A Coffin Award at the Edison Electric Institute's meeting in New York.

The Award, established in 1922 in memory of the late Charles A Coffin, founder of the General Electric Co, consists of a gold medal, a certificate of accomplishment and $1000 for the employees' benefit fund of the winning company. Top-ranking prize in the electric industry, it is awarded annually to the company achieving the greatest advancement in its operation and physical plant, thereby making a distinguished contribution to the development of electric light and power for the convenience of the public and the benefit of the industry." The award to the San Diego company was based on its splendid performance in meeting greatly increased industrial and defense loads and serving a large added population.

Lang Calls for Turbine Standardization

War has regimented the great individualist of the machine age—the steam turbine—into the ranks of the army of

GETTING THE *MOST* FROM YOUR THERMAL INSULATIONS...



NUMBER 5 in a series of messages to American industry devoted to conserving heat, improving operation and increasing production through modern insulation practice.

Like water lost from a leaking tap, the heat lost from an unprotected flange, valve or small pipe line may seem comparatively insignificant . . . but many of the few make much, and these steady small losses can quickly add to incredible totals.

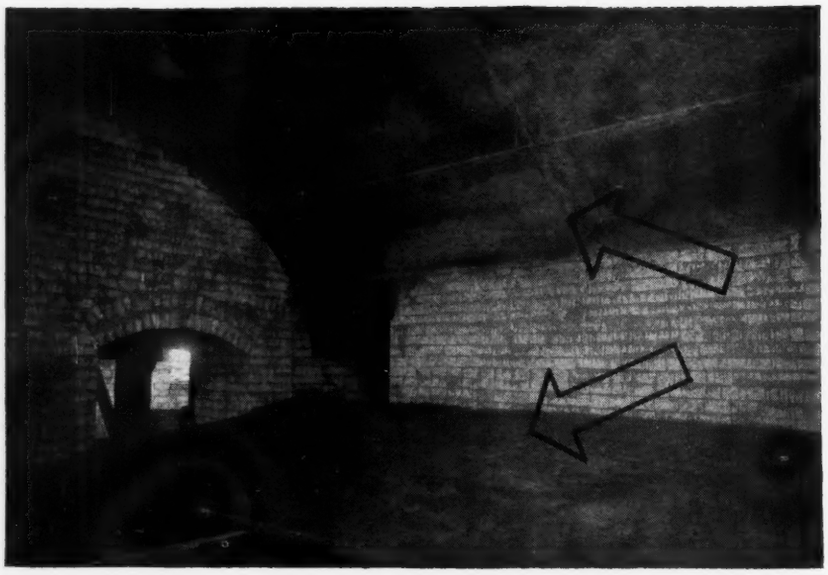
With operations under war demands proceeding at two and three times normal capacity, it is necessary that every possible pound of steam be generated, every last bit of heat conserved. The insulations on your boilers, piping and equipment should be maintained in good service condition, and all exposed lines, flanges and fittings should be adequately covered with an efficient, time-tested material . . . such as Ehret's 85% Magnesia.

★ EHRET'S 85% Magnesia and many other Ehret heat insulating materials are fully treated, both as to selection and application in the 176-page Ehret Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy of Handbook A209.

EHRET MAGNESIA MANUFACTURING CO.
VALLEY FORGE, PENNA.

...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

INCINERATOR ARCH AND FLOOR *quickly installed* WITH CASTABLE REFRACTORY!



Another example of jointless refractory construction for tough service—with a LUMNITE Castable Refractory

IT'S QUICK AND EASY. Today that is an important advantage of a Castable Refractory installation. In jobs like the arch and floor shown above, the cast-in-place refractory, made with LUMNITE, is ready for service 24 hours after placing. Large jointless sections are as easy to cast as small precast units.

You buy the dry prepared mixture of refractory aggregates and LUMNITE to start with. You add water to the mixture, right on the job... pour it in a simple form. It quickly gains high cold-strength and is ready for service in 24 hours.

For walls, arches, floors, you get a jointless, one-piece refractory that prevents loss of heat and infiltration of air, and does not suffer from moisture or steam. There is no cutting or fitting to do ... no ramming (you just tamp it in). No shrinkage to bother about. Spalling resistance is high. Upkeep costs are low.

When you use a Castable Refractory made with LUMNITE, you are sure of a balanced refractory, the result of careful selection of the most suitable aggregates and the hydraulic binder—LUMNITE—that made Castable Refractories possible. You can get different types of Castables to meet different temperature and insulation requirements. Refractory manufacturers sell them through their distributors throughout the country.

The Atlas Lumnite Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Building, New York City

Specify **CASTABLE REFRACTORIES MADE WITH LUMNITE**

mass production goods being produced to smash the Axis and it can be kept marching profitably for the utility industry when the Victory Parade is over. This possibility for progress was pointed out in an address by Chester H Lang, vice-president of General Electric Co, before the annual meeting of the Edison Electric Institute.

Mr Lang said that the job now being done in turning out propulsion turbines for the Navy and merchant fleet has proved the practicability of repetitive manufacture of standardized designs of heavy apparatus. It makes possible lower costs and fosters rather than restricts the development of more efficient machines because engineering talent can be concentrated on a small number of promising designs.

Citing the manner in which the utility industry has furthered advancement of standards for meters, distribution transformers and lamps, Mr Lang stated that there should be no reason for not exploring the possibilities of extending the same standardization to heavy apparatus. "All wars teach lessons and advance technology—at great cost to be sure," he said. "We shall have failed in our duty if we do not make the most of the helpful lessons this one is teaching us. To us in industry one lesson can be this:

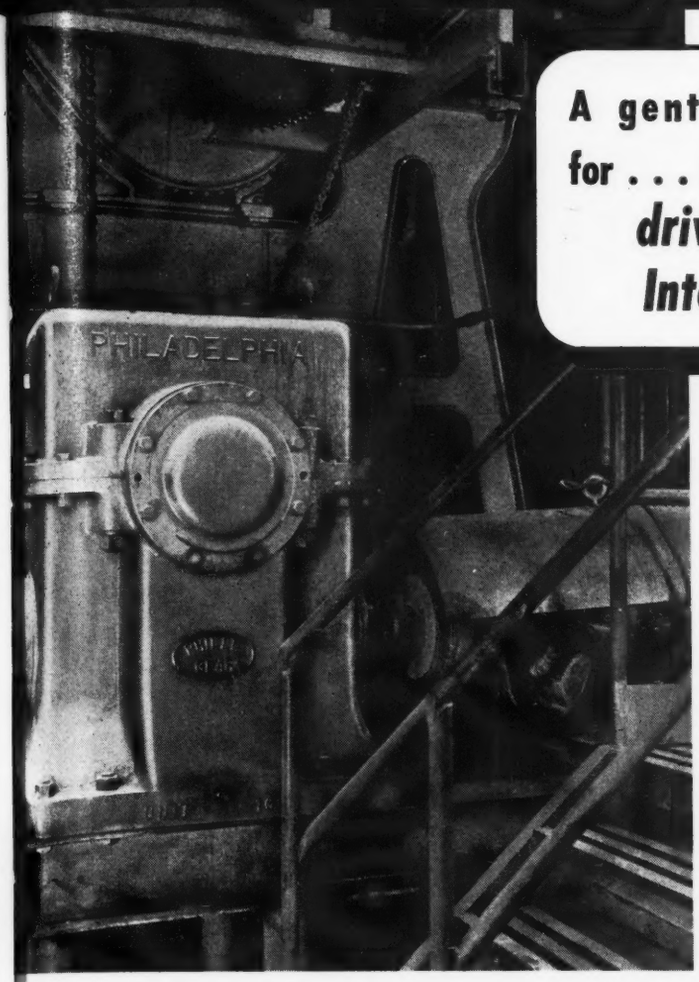
"There is no obstacle other than habit or tradition that stands in either your way or ours to block the extension of standardized manufacture, with all its resulting advantages, to the substation, the transmission system—yes, even to the generating station."

Steam Power Course

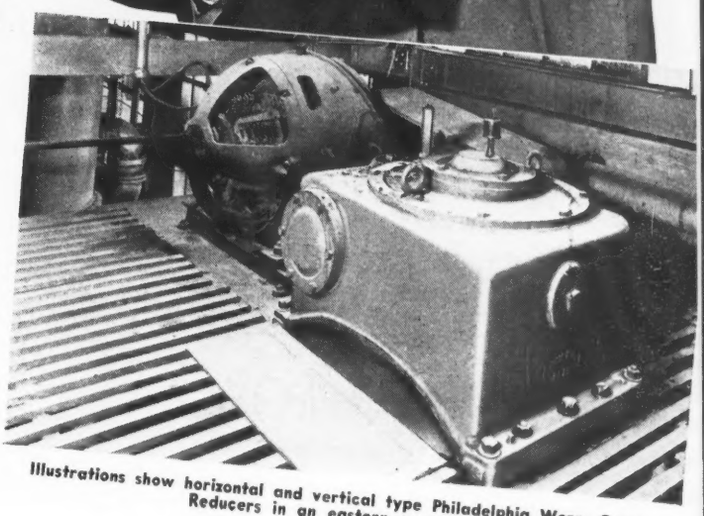
The University of Minnesota, Institute of Technology, Minneapolis, Minn., has completed a course entitled "Steam Power Plants One." This is a course for boiler operators and persons concerned with the generation and use of steam. The course is being given by the Correspondence Study Department. Further information about the course can be obtained by addressing R E Summers, Associate Professor of Mechanical Engineering, University of Minnesota.

Five Irrigation Projects Supply a Million Kilowatts

More than a million kilowatts of hydro power will be added to the nation's war supply by July, 1944, at five Bureau of Reclamation multi-purpose irrigation projects in the West, Secretary of the Interior Harold L Ickes



A gentleman calling for . . . *A dependable drive to Stop Interruptions*



Illustrations show horizontal and vertical type Philadelphia Worm Gear Reducers in an eastern sugar refinery.

PHILADELPHIA WORM GEAR SPEED REDUCERS

have proven their dependability for many years. Now, with today's stepped-up production schedules requiring many plants to operate continuously, the correct choice of a drive is most essential.

Philadelphia Worm Gear Units can and are meeting these new demands. They are ruggedly constructed and adequately housed to assure sufficient heat radiating area. Each Philadelphia Worm Reducer, whether a horizontal or vertical type, is built with individual service characteristics to perform the required job with maximum efficiency (from 85% to 95% average) and economy, but with minimum maintenance.

A wide range of horsepowers and ratios is available. Send now for our complete catalog.

PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
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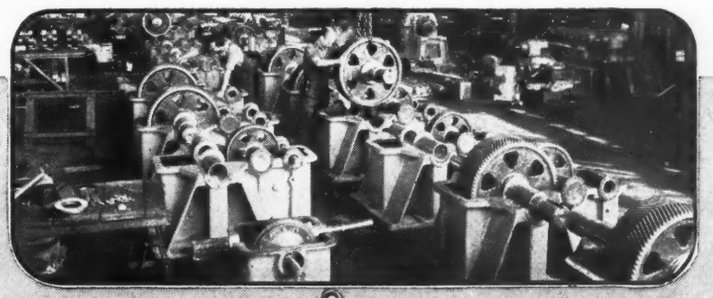
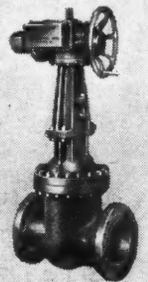
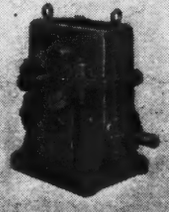
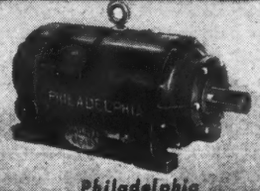




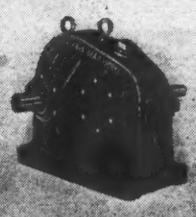
Philadelphia
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.



Philadelphia
WORM GEAR SPEED REDUCER
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.



Philadelphia
MOTOREDUCER
The economical self-contained drive. Horizontal or Vertical types — various ratios and horsepowers.



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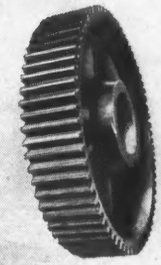
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



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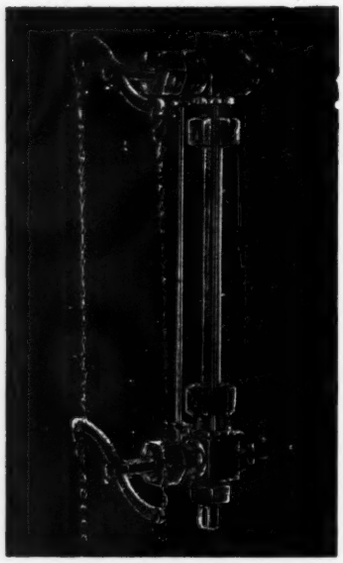
GEARS
All types and sizes of industrial gears. Can be supplied in all materials.



"PBH" Vertical Gauge

"PBH" Tiltview Gauge (Patented)

Quick as a YANK!—

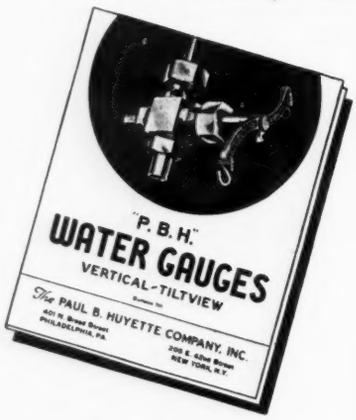
Accidents sometimes happen even to the superfine quality glass used in

HUYETTE WATER GAUGES

But a broken glass is no cause for scalds or burns, because Huyette Gauges are closed with one yank of the valve chain—a quarter turn does it.

Check These Exclusive Features:

All valves are polished, heavy, well proportioned and made of Bronze mixture according to A.S.M.E. Code. Maximum working pressure stamped on each valve. Glass and stem nuts are large to accomodate ample size packing to insure steam proof-leak tight service. All extra heavy valves have monel metal loose disc valve stem tips and 3/8" union drain or blow off connection on lower valve. Stem packing is the gland type ample in size. All gauges can be equipped with automatic ball check.



◆

For the complete PBH line of Power Plant Equipment, write today for catalog A34R.

THE PAUL B. HUYETTE CO., INC.

Established 1896

405 N. BROAD ST., PHILADELPHIA, PA.

announced on the date of August 11.

Higher priorities just granted by the War Production Board for Reclamation dams, powerhouses and generating equipment insure this large installation of war power, Secretary Ickes was advised by H W Bashore, Acting Commissioner. Bureau of Reclamation.

The additions will bring the total operating capacity of Reclamation power plants in 12 states to 2.5 million kw and the potential annual output will be more than 20 million kwhr.

"These million additional kilowatts mean fighter planes, bombers, ships, tanks, and guns in increasing volume for the Army and Navy," Secretary Ickes said. "That the Department of the Interior has the facilities under construction to bring in this power shows its preparedness to turn western water resources into war material.

"I am especially gratified that these priority ratings will permit us to complete Shasta and Keswick dams, of the Central Valley project in California, so that the waters of the Sacramento River can be turned into hydro power for war production on the Pacific Coast. Power plants at these dams, with the transmission system I have urged, will enable Shasta and Keswick dams to do for northern California what Grand Coulee and Bonneville are doing for the Pacific Northwest and Boulder for the Pacific Southwest.

"Since December 7, the Bureau of Reclamation has brought in 303,500 kw of power. In addition to the 1,055,600-kw capacity that is assured by the new priority ratings and which will be on the line by 1944, the Bureau of Reclamation is prepared to add another 700,000 kw in projects in operation or under construction. In other words, this one Government agency is prepared to provide a total of 3,200,000 kw of power for the prosecution of the war. The total is nearly 2.5 times the entire power capacity on the Pacific Coast in 1920."

Already pushed at wartime tempo, work on installation of Reclamation generating equipment and other facilities will now be continued at top speed with materials provided under the new ratings. The first generators to reach completion under the new priority schedule are located at Parker Dam on the Colorado River, in a new plant, the 29th to be placed in operation by the Bureau of Reclamation. New hydro equipment will also go on the line at Boulder Dam. In the Pacific Northwest, new aluminum center of the nation, Grand Coulee Dam on the Columbia River is due for heavy installations.

Looking down on the world from above the North Pole. This map may look distorted to you, but actually it shows the relative position of the land masses in the northern hemisphere with very little lineal distortion. Below the equator the distortion increases more rapidly, but there is no distortion north and south.

How many miles of pipe in 23,000,000 tons of shipping?

Enough to run a pipe line from Texas to England, Russia, Egypt, India, China, Australia, Hawaii and back

TWENTY-THREE million tons of merchant shipping, the program for 1942-43, will require approximately 35,000 miles of pipe and tubing. This would be enough to run a pipe line to every one of the United Nations shown above.

One 30,000-ton vessel consumes as much as 50 miles of pipe. Another 10,000-ton freighter requires more than 15 miles of pipe. Smaller ships use as much or more piping in proportion to their tonnage. A conservative rough average might be 15 miles of pipe for every 10,000 tons of shipping.

35,000 miles of pipe is a lot of pipe —stretching almost one and one-half times around the world. That gives you a clear picture of the enormous job ahead for the Nation's pipe manufacturers.

But the pipe industry is used to big orders. NATIONAL Tube alone has often turned out seamless pipe orders in terms of hundreds of miles. Big pipe, too, in all sizes up to 24 inches.

If you could see the ceaseless 24-hour a day activity at our mills, you, too, would share our confidence that, whatever the call for tubular products—for ships or planes, tanks or bombs, NATIONAL Tube will do its full share in meeting the emergency.

NATIONAL TUBE COMPANY

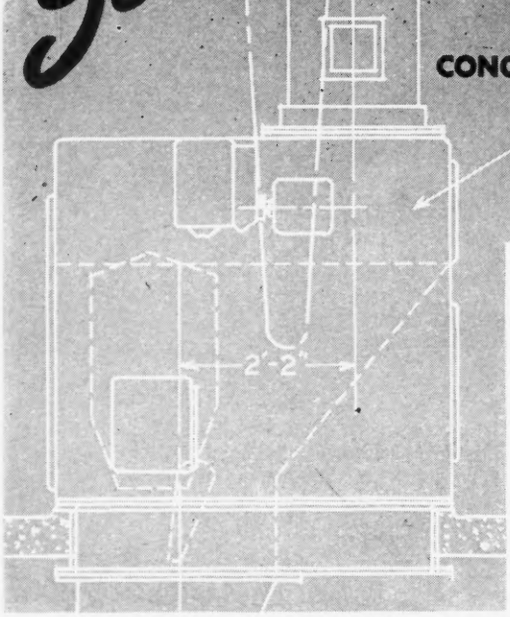
PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

Seco COAL SCALES

...NOW SPECIALLY DESIGNED FOR CONCRETE INSTALLATIONS



• SECO COAL SCALES are now newly designed with an insert for concrete boiler feeding installations. This eliminates special designing on your part. SECO Coal Scales are a part of STOCK'S "BUNKER-TO-STOKER and BUNKER-TO-PULVERIZER" service. For detailed drawings, write today!

COAL VALVES • COAL SCALES
COAL DISTRIBUTORS
COMPLETE "BUNKER-TO-STOKER AND BUNKER-TO-PULVERIZER" INSTALLATIONS

STOCK ENGINEERING COMPANY

9803 THEODORE AVE. • CLEVELAND, OHIO

HERCULES
Seamless Copper
FLOATS

GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

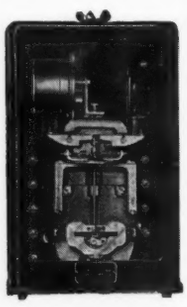
Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

Automatic Frequency and Proportionate Load Control

BURLINGTON

• Applicable to the regulation of all sizes of A.C. generating units



• This instrument has maximum sensitivity, and operates reliably with minimum maintenance. Simplified, rugged construction. Integrated time-error compensation and proportionate loading of generating units. Write today for circular. Also ask for circulars on Burlington Voltage Regulators and Automatic Synchronizers.

BURLINGTON
INSTRUMENT CORPORATION
Burlington, Iowa

Changes Made in Priority Ratings

Provision for rerating war orders and for applying a new series of high preference ratings is made in Priorities Regulation No. 12 and amendments to Priorities Regulations 1 and 3, issued recently by the Director of Industry Operations.

The new ratings are AAA, AA-1, AA-2, etc., all of which take preference over A-1-a rating. AA, heretofore the highest rating, use of which was permitted only by special authorization, is now abolished, and all outstanding AA ratings are automatically changed to AA-2. The chief purpose of the rerating is to permit greater flexibility in the assignment of preference ratings to definite quantities of military and related non-military items, most of which have recently been either AA, or in the A-1 series. It will permit the use of top ratings for a balanced program of urgent war materials without seriously disturbing the pattern of ratings for other war and essential civilian orders.

"Rerating" Forms

A special form PD-4X, called a "Rerating Direction" is described for use where the Army, Navy, or other Government war agency rerates deliveries of war materials to be made directly to it. Rerating directions must include the allocation classification and purchaser's symbols required by Priorities Regulation No. 10.

A separate form called a "Rerating Certificate," PD-46, is provided for use by a manufacturer whose delivery to a war agency had been rerated, so that he may in turn rerate related deliveries to be made to him. A manufacturer may apply or extend the rerating to material which will be delivered by him on a rerated order, or physically incorporated in material so delivered, or to restore inventories to a practical working minimum when material has been taken from inventory to fill a rerated order. The new ratings may also be used by small companies for certain operating supplies which will be consumed in filling the rated order, up to 10 percent of the cost of materials to be processed, provided that not more than 25 percent of such operating supplies are metals in the forms listed in Priorities Regulation No. 11. Such reratings may not be used to obtain operating supplies by any company whose use of the metals listed in Regulation 11 amounts to more than $5,000 in a quarter. Most such companies obtain ratings for their operating supplies under the Production Requirements Plan.

Now Building....

36,000 SQUARE FEET LUMMUS SURFACE CONDENSER For A Well-Known Central Station

Two large surface condensers under construction at Honesdale plant. Right: conventional, external type atmospheric relief valve. Left: Lummus built-in type of atmospheric relief valve — saves space, provides additional support.

Among several large surface condensers under construction at the Honesdale plant of The Lummus Company is a 36,000 square feet condenser. Interesting features of Lummus design contributing to the efficiency of this condenser are:

Distinctive tube sheet layout, providing large internal steam space, permitting free longitudinal steam distribution.

Full deaeration within the condenser—all condensation being run over plates and exposed to live steam.

Entire design, including air coolers, contained within circular shell — no external steam domes or other parts to take up unnecessary space.

Write for data on Lummus Surface Condensers, Steam Jet Air Pumps, Extraction Heaters and other heat exchange equipment.

THE LUMMUS COMPANY · 420 LEXINGTON AVE., NEW YORK, N.Y.

LUMMUS

FOR HIGH PRESSURE FLUID SYSTEMS,

USE THIS "HRI" RELIEF VALVE

Engineered for exacting service. Standard for service-range of 400 to 1000 lbs. pressure. Sizes: 2" to 6", inclusive. Model "HRX"—same design principle, but with extra-heavy construction and alloy trim—available for pressures of 1000 to 5000 lbs. *For details, write*

J. E. LONERGAN COMPANY
Race and Second Streets
Philadelphia, Pa.

Lonergan
70th Anniversary
SINCE 1872—MAKERS OF PRECISION
VALVES · GAUGES
SPECIALTIES

HENSZEY
BOILER FEED
REGULATORS

The Henszey Boiler Feed Regulator controls boiler water levels continuously and accurately under *all* load conditions!

These simple, compact, self-contained units go right in the feed line and require no additional structural support. They are as easy to install as a simple gate or globe valve. Once installed and set for operation no further attention is necessary—nothing to get out of order—nothing to reset.

Send for latest Bulletin containing full details.

HENSZEY COMPANY
Dept. D9—Watertown, Wis.

Plastic-Steel Pump For Fighting Bombs

Welded steel tubes, simple stamped steel parts, glass marbles, and plastics are the only materials used in the new OCD stirrup pump for fighting incendiary bombs, it was revealed in an article in *Product Engineering*, authoritative magazine of engineering design. Principal features of the pump, in addition to its non-strategic materials, are low cost, light weight, and sturdy, clog-proof construction. Steady water pressure can easily be maintained, even by one untrained in its use.

The plastic nozzle, designed especially for fighting incendiaries, permits the air raid warden to change quickly from a fine spray to a steady stream merely by pressing a thumb valve. When the thumb is released, the valve springs back to spray position, reducing the danger of accidentally directing a steady stream on the bomb.

Design of the pump was kept simple so that it can be made by many manufacturers on machines not needed for other war production. Barrel and plunger are made of welded steel tubes, finished with black baked enamel. Stirrup can be either welded steel tubing or a simple steel stamping. Rigidity of the plunger and stirrup is said to be better than that of pumps previously available. Sufficient rust resistance for average practice and stand-by use is given to the smaller steel parts by chemical black finishes. The hose will be made of plastics, containing no rubber.

The valves, ordinary glass marbles seating on molded plastic parts, exemplify the simplicity of the design. Glass balls for the first few pumps produced were purchased at the marble counter of a five-and-dime store by an engineer who tested them for size with a ring gage. Those that dropped through the ring were purchased; those that didn't were rejected.

The new stirrup pump, full design details of which are given in *Product Engineering*, was designed jointly by WPB, OCD, and the welded tube and plastics industries.

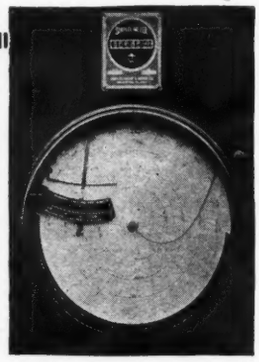
"Keep 'Em Rolling," Goodrich Sound Film

The dramatic story of rubber in transportation and its vital role in the fight to be carried to the enemy by the United States and United Nations is the theme of a new B F Goodrich Company sound film now ready for national release.

Organized groups, such as schools, luncheon clubs, service organizations,

WHAT DOES SIMPLEX
7 DIGIT TOTALIZER
MEAN TO YOUR
FLOW RATE RECORDS?

READ TOTAL FLOW ACCURATELY —ANY TIME!



Clear-cut black figures on white background means easy reading from a distance — the seventh digit makes a great difference, too.

Simplex MS Meters feature a seventh fractional dial on the totalizer which simplifies integrating of flow, and adds weeks of continually increasing daily computations before the counter returns to zero.

What the 7 Dial Counter Means to You

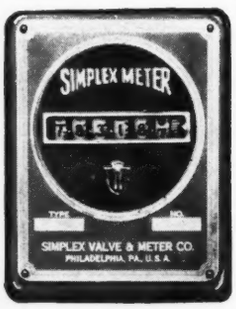
(1) Highest accuracy — continuous friction disc drive is super-sensitive — it reacts immediately to the slightest variation of flow conditions, thus assuring absolute maximum continuous totalizing efficiency.

(2) Read total flow directly at a glance any time.

(3) Only zero is used as multiplying factor.

(4) The seventh fractional digit is a means of closely checking the flow.

The Simplex 7 Digit Totalizer used on Type MS Meters is a precision unit designed to minimize backlash in gearing. It is housed in dust-proof and tamper-proof case. Synchronous electric or Seth Thomas mechanical clock drive is optional.



The Simplex Type MS Meter can be furnished for wall, panel, or floor stand mounting.

For year-round accuracy and ease of totalizing rate of flow be sure it's a Simplex Type MS Meter. Write for our latest descriptive literature.

SIMPLEX VALVE & METER CO.
6780 Upland Street, Phila., Pa.

SIMPLEX
POWER & PROCESS
METERS
THE METER WITH THE BELL SHAPED FLOAT

They rarely need attention... BUT they deserve it now!

● The micrometers, used in the manufacture of Sloan Flush Valves, rarely need attention. But micrometers are mechanical instruments and are subject to wear. Knowing this, we of Sloan Valve Company do not take our micrometers for granted. We keep them in constant accuracy.

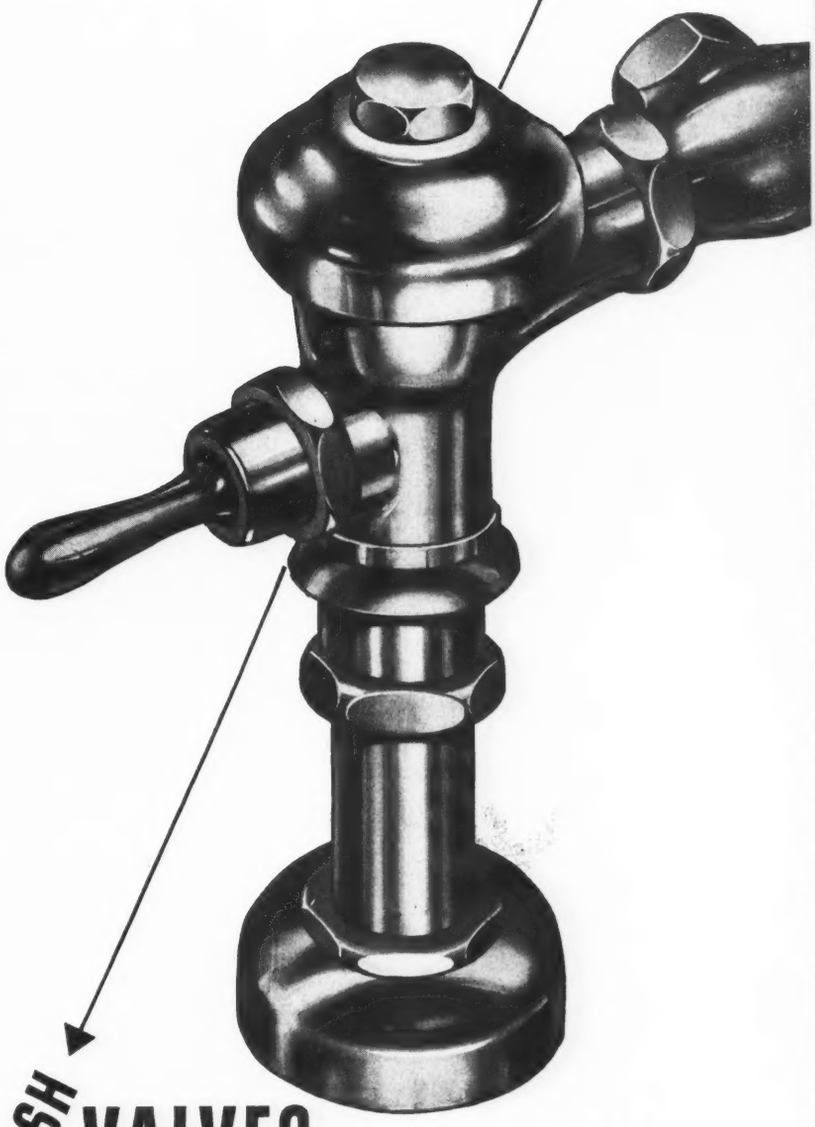
The same should apply to you and your Sloan Flush Valves. Just because your Sloan Flush Valves have given you years of trouble-free service, don't take them for granted. Check them periodically to see that their operation is accurate. Remember, a single small part for replacement is easier to get than an entire new flush valve.

So we urge you to call in a master plumber today and have him check everyone of your Sloan Valves. Probably many of them will need no attention whatever. Probably only a *few* repairs will be required. But you need to have the assurance that your every Sloan Flush Valve is working perfectly, still as good as new and ready for many more years of trouble-free service.

All the material used in the manufacture of your Sloan Flush Valves is on the critical list. Conserve vital metals by proper maintenance.

SLOAN VALVE COMPANY

4300 West Lake Street, Chicago

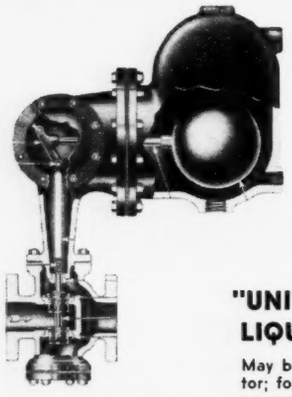


SLOAN FLUSH VALVES

K & M
LIQUID LEVEL CONTROLS since 1879

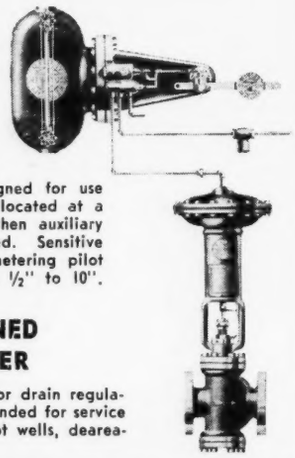
We're "ALL OUT" so the AXIS will be "ALL IN" Please bear with us for the duration —

Kieley & Mueller has been manufacturing precision controls for 63 years. This long specialized experience is behind K&M Liquid Level Controls which are designed to meet the most exacting requirements of present day service. The units shown here are typical of those included in the complete K&M line.



"REMOTROL" PILOT OPERATED LIQUID LEVEL CONTROLLER

A precision pilot control designed for use on applications where valve is located at a distance from float cage or when auxiliary controlled main valve is desired. Sensitive operation assured by special metering pilot and pilot linkage. Valve sizes: ½" to 10".



"UNITROL" SELF-CONTAINED LIQUID LEVEL CONTROLLER

May be used either as a feed regulator or drain regulator; for pressures up to 250 lb. Recommended for service on recirculating systems of condenser hot wells, deareators, etc. Valve ½" to 4".

KIELEY SINCE 1879 MUELLER

KIELEY & MUELLER

General Offices and Factory

2013-2033 — 43rd Street, North Bergen, N. J.

Reducing Valves — Liquid Level Controls — Float Valves — Pump Governors — Strainers — Control Specialties.

Coal Storage Simplified

with an economical

Sauerman Scraper

6 CU. YD. SAUERMAN SCRAPER TAKES CARE OF 100,000-TON STOCKPILE

Above picture shows storage system with 450-ft. operating radius that stores and reclaims 200 t.p.h. at large generating station.

SMALL SCRAPER STORES AND RECARE OF 100,000-TON STOCKPILE

Here is a ¾ cu. yd. Sauerman unit installed on a irregular strip of ground alongside an unloading trestle. It handles all the coal burned by an industrial power plant—averaging 120 tons per day.

Any plant that lacks adequate facilities for stockpiling coal can remedy matters quickly and economically by installing a Sauerman Power Drag Scraper. The advantages of this equipment are:

ECONOMY—Capital cost is low. Machine is operated by one man. About ¼ kwh. of power is consumed for every ton of coal moved 100 ft. Maintenance averages about ½¢ per ton stored or reclaimed.

FLEXIBILITY—No matter what the shape of an area, the scraper makes complete use of the space. Coal is reclaimed from any point in the pile just as easily as it is stored.

MINIMUM FIRE HAZARD—Scraper spreads the coal in well packed layers, so that there are no air pockets to create hot spots.

An illustrated catalog which gives details on the correct equipment layouts for coal storage projects of every size and description, will be mailed gladly on request.

SAUERMAN BROS., INC.

562 S. Clinton Street Chicago

granges, trade groups and others may obtain a showing of the film in 16 millimeter size by request to the company's principal offices in Akron, Ohio, or by application to any of the sales agencies in the field, including district offices, stores and dealers.

Titled, "Keep 'Em Rolling," the film runs 25 minutes, and was prepared under supervision of the truck and bus tire department of B F Goodrich.

Highlighting the urgent need for rigid conservation of tires so the nation may roll to victory, the climax of the picture consists of scenes showing rubber equipped combat vehicles moving against the enemy. These include scout cars, artillery tractors pulling the guns into place, supply trucks of various types, as well as tanks with their massive rubber treads.

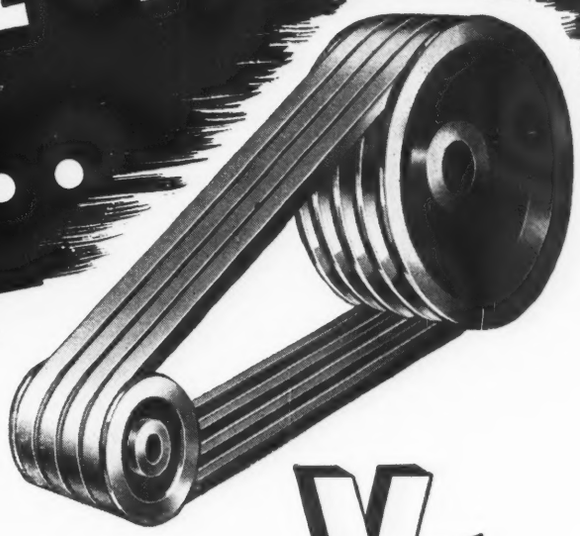
Utilities Discuss Wartime Policies

Executives of 35 operating companies from all parts of the country met in Washington at the call of the Council of Electric Operating Companies, on June 24th, to discuss what forehanded plans and policies the industry can adopt which will offer the greatest help to government agencies if war-power shortages should occur. The companies represented operate more than one-third of the nation's utility generating capacity.

The conference recognized that while so far the industry has met the added demands of war industries, as the war program continues to develop additional steps will have to be taken to integrate and coordinate operations in regional areas. To this end, those present agreed unanimously to urge all companies to cooperate with each other, and with governmental war agencies "in order to utilize existing facilities to the maximum, and to make available the maximum feasible supplies of electric power." Council President Tom P Walker was authorized by those present to advise the appropriate government agencies of this action.

The meeting did not take up technical operating problems created by following out these policies. It is expected that these will be taken up and acted upon on a regional basis where it is appropriate, under the stimulus of those attending the Washington gathering. In convening the meeting, Mr Walker pointed out that the WPB Power Branch has gotten out order L-94 for handling power shortages on an area basis, when such shortage areas are defined by WPB. He pointed out that

How to get maximum life out of your MULTIPLE V-BELT DRIVES!...



FREE ASSOCIATION BOOK, JUST PUBLISHED, TELLS YOU WHAT TO DO AND WHAT NOT TO DO

UNDER THE pressure of war production, 16 to 22 hours a day operation is using up the life of V-Belts at an unprecedented rate... two to three times faster than normally. Consequently, the demand for replacements has increased in the same ratio at a time when rubber is urgently needed for other war essentials.

As a user of Multiple V-Belt Drives, it is not merely advisable that you conserve the life of your belts... it's imperative... it's a patriotic MUST! Even a month or two of additional belt life is well worth while when you remember there are millions of V-Belts in service.

Realizing the importance of keeping Multiple V-Belt Drives turning for the war effort, the association has published a book of "dos" and "don'ts" to enable power-users to postpone belt replacements. This book, "23 Ways to Conserve the Life of Your Multiple V-Belt Drives" is FREE to power-users. Get it, study it, and apply its recommendations. You'll not only help conserve rubber, but you'll reduce your maintenance costs.

MULTIPLE V-BELT DRIVE ASS'N

TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence . . . the result of cooperative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASSOCIATION

140 SOUTH DEARBORN ST., CHICAGO

Multiple V-Belt Drive Association
140 S. Dearborn St., Chicago

Please send us a copy of your free book, "23 Ways to Conserve the Life of your Multiple V-Belt Drives."

Name.....

Firm.....

Address.....

OXYGEN CORROSION

And how to guard against it!

HERE'S a simple...easy...inexpensive way to guard against the serious menace of oxygen corrosion: *give your boiler feed water continuous treatment with Santosite!*

Even though your boiler feed water be distilled...even though you have good, efficient mechanical deaeration ...overloads or leakage of air into your boiler system are a constant threat of oxygen corrosion. Continuous treatment of your boiler feed water with Santosite (sodium sulfite) is your best insurance against that threat.

Once added to the extent of about 30 parts per million, a simple test will reveal the amount of Santosite present and provide a reliable check on any increases in oxygen due to increased loads or air leakage anywhere in the system before any damage can be done.

Depending on the oxygen content of water treated, the cost of insuring your boiler system against oxygen corrosion with Santosite will vary from $0.05 to $0.65 per million pounds of feed water.

Simple and easy to apply, Santosite produces no objectionable sludge formation and does not discolor feed water. An anhydrous, crystalline product, it is easy to handle and store.

SANTOSITE

For full details, inquire: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

"E" FOR EXCELLENCE—The joint Army-Navy "E" burgee, "representing recognition by both the Army and the Navy of especially meritorious production of war materials," has been awarded to Monsanto and now replaces the Navy "E" first awarded Monsanto December 31, 1941.

while most of its provisions are inapplicable until WPB acts, the order does "furnish the industry an opportunity to prepare some plans in advance and thereby be better able to cooperate to the fullest extent with the War Production Board."

New Heat-Exchanger Production Needed

New industrial facilities capable of producing double the 1941 output of heat-exchangers within the next 12 months are being sought by the War Production Board through its Heat-Exchanger Industry Advisory Committee. The program represents one of the biggest conversions yet undertaken for other than direct war production.

Plants desiring to participate in the mass expansion must have sufficient crane capacity and building height to handle heat exchangers which range in size from one to 12 ft in diameter, and from four to 40 ft in length. It is planned to assign the engineering work to established concerns, then turn over drawings to other shops for manufacture; considerable standardization and simplification of design is contemplated to speed this work.

It is anticipated that a large part of the additional production volume will be obtained from the refrigerator, radiator and railroad industries in plant space formerly used for now-halted civilian output.

Fifty-three heat-exchanger concerns produced $60,000,000 worth of condensers, coolers, water heaters, etc in 1941, and expect to turn out $80,000,000 worth this year. The war program needs $200,000,000 worth of this equipment to equip new plants for the manufacture of chemicals, explosives, synthetic rubber, and aviation gasoline, in addition to the increased volume of requirements for land and ship power plants.

U. S. Acquires Private Utilities in Porto Rico

Brig Gen Philip D Fleming, Federal Works Administrator, announced that as a war measure, and at the direction of the President, the Federal Works Agency had instituted court proceedings to take over the Porto Rico Railway Light and Power Co, and the Mayaguez Light, Power and Ice Co, thus placing the electric power service on the Island of Porto Rico under unified public control for more effective defense of the Carribean and the hemisphere.

On motion of government counsel,

PACKINGS chart a course to Victory!

RECOMMENDATION CHART FOR THE USE OF BELMONT PACKINGS

APPLICATION	RECIPROCATING RODS AND PLUNGERS	CENTRIFUGAL AND ROTARY SHAFTS	GLOBE AND ANGLE VALVE STEMS	SHEET PACKINGS	GASKETS
	Style	Style	Style	Style	Style
STEAM High Pressure 340°F. and over	30 Asbestos Spiral Rubber Back 47 Asbestos Spiral Rubber Center 866 Semi-Metallic 745 Braided Asbestos Square 329 Asbestos Hollow Center	745P Square Braided Asbestos 2056 Shredded Metal, Cotton Covered 4000 Plastic 4010 Plastic (over 550°F.)	655 Braided Asbestos, Vulcanized 610 Braided Asbestos, Lubricated 740 Twisted Asbestos, Lubricated 4000 Plastic 4010 Plastic (550°F.) 2001 Shredded Metal (up to 550°F.)	590 Compressed Asbestos 591 Compressed Asbestos 595 Compressed Asbestos 603 Woven Asbestos W.I. 611 R. & B. Woven Asbestos W.I.	589 Compressed Asbestos 588 Compressed Asbestos 596 Compressed Asbestos 625 Woven Asbestos W.I. 629 R. & B. Woven Asbestos W.I.
STEAM Intermediate and Low Pressure under 340°F.	319 Hollow Center 1000 Cross Expansion 102 Extra Rubber and Duck 2 Expansion Channel 203 Combination Diagonal H.P. 204 Combination Diagonal 85 Combination Set, High Speed	745P Square Braided Asbestos 2056 Shredded Metal, Cotton Covered 4000 Plastic 2001 Shredded Metal	610 Braided Asbestos, Lubricated 740 Twisted Asbestos, Lubricated 4000 Plastic 2001 Shredded Metal	602 Black Sheet	642 Black Sheet

While these recommendations are based on years of experience, no guarantees are made in view of the many peculiarities that may center around one application as compared with another of similar nature. Consult with us for special or unusual services.

VICTORY is the target at which we're shooting, and though it's only nine months since the scrap began . . . production, the big gun of America, is now scoring bulls' eyes.

Spouting from the assembly lines throughout the Nation are the planes, guns, tanks, ships and other essentials so necessary to this all-out war effort. To keep these weapons pouring forth is the job that faces industrial America today.

Men are working longer, machines harder. Under this terrific strain wear in equipment is bound to be more prevalent. Extra precautions must be taken or vital parts are apt to go, losing time our most precious asset in this battle of mechanization.

Packings play their part in this gigantic production program. This advertisement is published as an industrial service to help save your time when a packing selection must be made. If the problem is steam, this chart will guide you in making the proper Belmont Packing selection to meet your requirements.

THERE'S A BELMONT PACKING FOR EVERY SERVICE . . . Steam, Water, Oil, Gas, Air, Acid, Alkalis, Ammonia. FORMS INCLUDE . . . Rings, Coils, Spirals, Reels, Spools, Sheets, Gaskets.

Belmont Packings are Sold by Authorized Belmont Distributors in Every Large Industrial Center

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

● For those desiring more detailed information the Belmont Catalog is available. This book contains 84 pages of packing information reduced to its simplest form. All types of Belmont Packings are illustrated and described. Packing end views are pictured in large size showing minute details. Constructions, applications, tables of weights, all are included. The Belmont Packing Catalog has been prepared by packing engineers. It's a book you should not be without. Write on your Company letterhead for your copy, today.

BELMONT PACKINGS

THE BELMONT PACKING & RUBBER COMPANY

DEPT. P-942

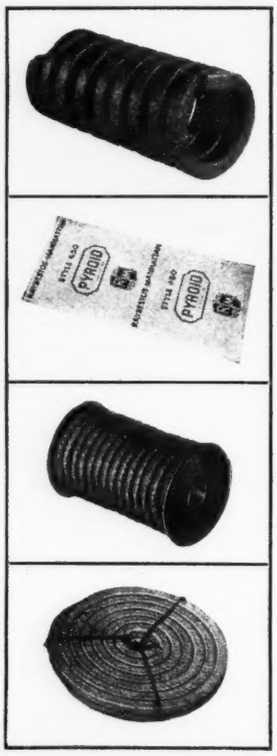
BUTLER AND SEPVIVA STREETS • PHILADELPHIA, PENNSYLVANIA

R/M PACKINGS won't let go

With a war to win in which production plays a star role, this is no time for packings to let go . . . on steam lines, oil lines, air lines, or fuel lines. R/M packings are more than "a thumb in the dike." They *really* seal, to hold the new and higher pressures.

At Raybestos-Manhattan, R/M engineers burn the midnight oil to keep these packings ahead of the parade. It is *their* job to see that R/M packings do their job, not only well but for longer periods. You can count on R/M packings to hold that line. They won't let go.

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy of this catalog from your R/M distributor, or write us direct.



INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

Judge Robert A. Cooper signed an order giving the government possession of the two properties. General Fleming said that the unification will help to save fuel oil, and to relieve difficulties of oil transport. Systems will be integrated with publicly owned utilities, and will be operated for the Federal Works Agency by the Porto Rico Water Resources Authority which now owns and operates several hydroelectric generating stations. This will permit the substitution of hydroelectric power for steam power in the areas that have been served by the private companies, and will assure availability of an increased amount of energy.

The Porto Rico Railway Light and Power Co has operated the electric power system in the northeasterly portion of the island, including San Juan, serving a population of approximately 700,000. The Mayaguez Light, Power and Ice Co has operated a small power system in the extreme southwesterly portion of the island, serving about 65,000 persons.

Wide Use Of Mercury Power Plants Predicted

The war has stopped the extension of the mercury power plant to many important applications, but there is every reason to believe that it can be considered the "power plant of the future," H N Hackett, of the General Electric construction engineering department, stated in an address before the Northeastern District Meeting of the AIEE at Schenectady.

Pointing out that the over-all efficiency and reliability of the mercury power plant has been clearly demonstrated by more than 150,000 hours of commercial operation at Hartford, Kearny, and Schenectady, Mr Hackett indicated that future applications will include marine and naval vessels, railway locomotives, and mobile power plants.

"The mercury power plant has great possibilities," he said. "The field of application is large, as it can be built for almost any capacity or service. The mercury power plant offers the maximum in over-all efficiency; it is reliable, and easy to operate."

Mr Hackett stated that the maximum in plant efficiency is obtained by using the mercury steam cycle as a condensing plant.

When mercury power plants are used to make process steam, with either extraction or noncondensing steam turbines, they may deliver more than twice as much electric power per unit of process steam as could a conventional

$15,000 Saved
By Minor Installation Change

Enlarged tube sheet holes were causing chronic leaks at ferrule and packing joints of this power plant's condenser. Before purchasing new $15,000 tube sheets, the plant called a Scovill consultant to the scene. Scovill suggested a change in installation which not only eliminated the difficulties due to enlarged tube sheet holes, but the ferrule and packing as well. The change was made, saving $15,000.

Use the laboratory behind the page

. . . To Make Scarce Metals Serve You Better and Longer

"At 210° F., recommend 70-30 Cupro-Nickel" . . . said Scovill's laboratory technicians, solving a complicated heat exchanger problem for a Scovill customer. You too may find that Scovill's laboratories can help you find the right tube for the job, or make the tubes you have stay on the job longer.

Scovill's new Heat Exchanger Tube Manual well illustrates the wide scope of Scovill's Service to Condenser Tube users. When any special problem in metal arises, whether it be the selection of materials to resist corrosion . . . or an expert analysis of your conditions of heat transfer or fluid flow . . . use *the laboratory behind the page* for time-and-money-saving results.

The new edition of the "Manual" includes charts, formulae, specifications and technical discussions — all on subjects of interest to those engineers and associates who are constantly needing unusual practical data to help them solve their heat exchanger and condenser tube problems.

Another publication — "Scovill Condenser Tubes" — is available to others whose heat exchanger tube problems are concerned with the more common problems of corrosion, material selection and methods of installation.

And yet these two publications represent only one of Scovill's three services for power, marine, and refinery engineers. Scovill's service in Manuals is supplemented by Scovill's field service in men, and Scovill's laboratory service in metals. Write to Scovill Manufacturing Co., 13 Mill Street, Waterbury, Connecticut.

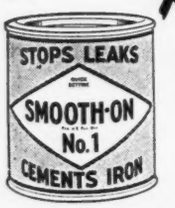
SCOVILL
Masters of Metal

Scovill Condenser Tubes

ONE PRODUCT...THREE SERVICES

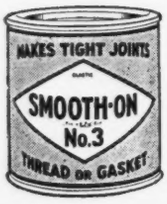
- **SERVICE IN MEN**
- **SERVICE IN METALS**
- **SERVICE IN MANUALS**

Here's a Complete Repair Kit

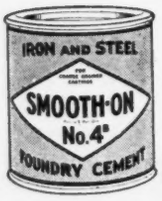


for hundreds of war-time repairs

SMOOTH-ON No. 1
Quick-Hardening
SMOOTH-ON No. 2
Slow-Hardening



For repairing cracks in boilers, heaters, evaporators, condensers, pumps, and other castings; stopping leaks at pipe connections, bolts, rivets, seams, etc.; and tightening loose parts of apparatus and fixtures.

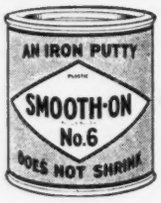


SMOOTH-ON No. 4

For truing up contours of castings and correcting surface blemishes. Selection of four grades to permit matching the color and grain of any iron or steel casting. Also foundry cements for brass, bronze and aluminum castings.

SMOOTH-ON No. 3
SMOOTH-ON No. 5

For making up tight screwed, flanged, hub or other types of pipe joints



SMOOTH-ON No. 6

For making watertight joints at roof flashings, glass frames, foundation and window joints, filling in seams and rivet heads.

SMOOTH-ON No. 7

For waterproofing walls and interiors of tanks and cisterns from the inside; for making hard, dustproof and oilproof concrete floors; and for repairing ruts, holes and cracks in concrete floors.

SMOOTH-ON Compositions are obtainable in various size containers from your dealer or, if necessary, from us. For your protection, insist on SMOOTH-ON, used by engineers since 1895.

FREE
40-PAGE HANDBOOK
Simple concise instructions on speedy effective repairs that will keep your equipment in good condition. Send the coupon for FREE copy.

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Do it with

9-42

SMOOTH-ON

850 psi, 850 F steam plant, with only a small increase in fuel.

"The simplest and most universal application of the mercury power plants will probably be for straight topping service," Mr Hackett said. "Here the maximum ratio of electric power is secured, and for certain topped steam pressure, more than 2½ times the electric power is produced by a mercury topper than can be had from a similar steam unit."

The 250- to 1400-psi pressure systems offer most attractive fields for mercury power plant applications, according to Hackett. He said that in this range they will always show large, favorable ratios of topping mercury to topping steam power, with very high over-all plant efficiencies.

"Ample demonstrations have been made in the 400-psi field by the three large mercury plants now operating. Designs and studies for other pressures and for other applications offer even greater possibilities for the economic use of mercury power plants," Mr Hackett concluded.

Calculator Will Help Plan Power Systems

To help speed the expansion of power systems feeding war industries in Indiana, Ohio, and Kentucky, Purdue University and six midwestern power companies cooperatively purchased a network calculator from the Westinghouse Electric and Manufacturing Company. The calculator soon to be installed can perform in a single hour calculations that would require an engineer nine months to compute on paper.

By creating and testing miniatures of power systems before they are built, the unit can calculate the materials and equipment required to supply power safely and efficiently with a minimum of electrical apparatus and expense.

To determine the number and sizes of generators, transformers, breakers and transmission lines required for a proposed power system, engineers must calculate in advance the probable voltage characteristics, rate of flow and other electrical values of that system. With the help of the network calculator, an engineer can solve such problems in a single hour that would take him an average of 1500 hours by ordinary mathematics. Also, the calculator can give the answers to certain problems that cannot be solved by any other method. By revealing ways to economize on equipment or to make existing systems delivery more power, the building of new lines is sometimes avoided.

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

*

Good advertising speeds information from those who have it . . . to those who need it.

*

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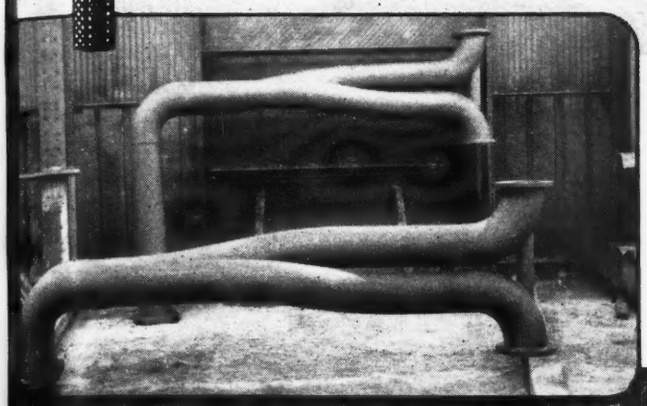
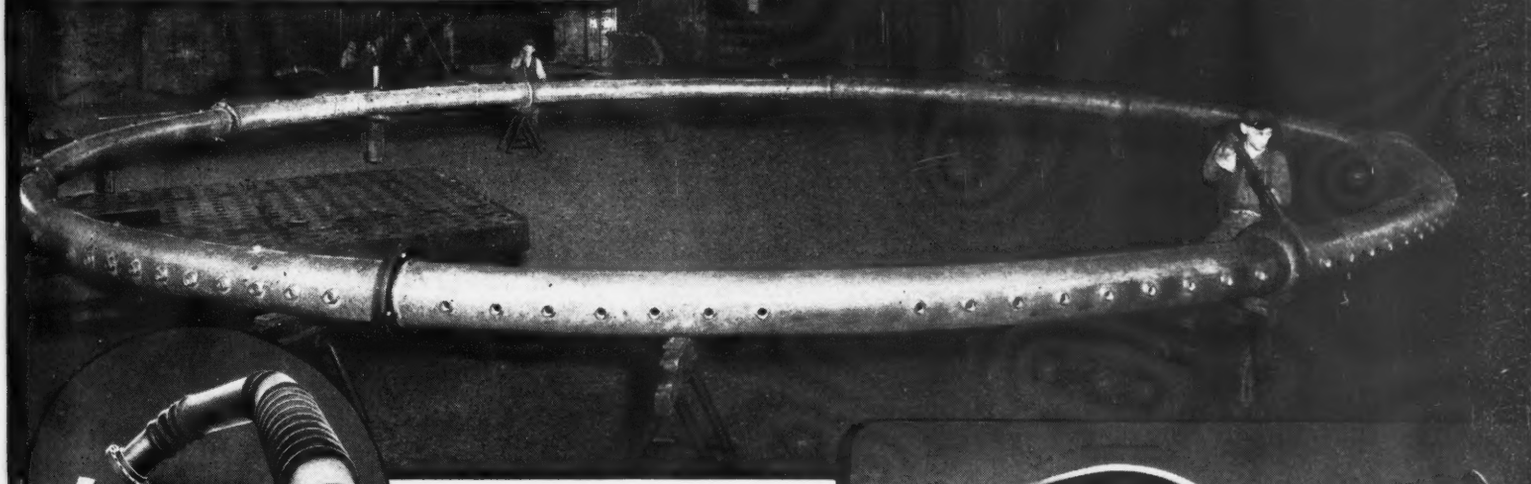
330 West 42nd Street New York

RECISION PRE-FABRICATION!

BY Pittsburgh Piping

AND EQUIPMENT COMPANY





Top Left—30' x 10" Digester Piping for Paper Mill

Center—44'6" x 12" Blast Furnace Cooling Ring

Lower Left—Super Flexible Corrugated Section of 10" High Pressure, High Temperature Steam Pipe

Lower Right—11' Long Stainless Type 430 Piping for Conducting Gas in Large Process Plant

PITTSBURGH Piping & Equipment Company is equipped to pre-fabricate ALL of your piping requirements, regardless of size, shape or material, from single assemblies to complete piping installations, with the utmost precision. A well trained engineering staff to lay out the correct design and make the proper selection of materials; modern equipment for bending, welding, flanging, machining, heat treating and hydraulic testing; crews of men who are experts in every phase of piping fabrication, insure the utmost accuracy of dimension. By pre-fabricating assemblies as large as shipping and installation facilities will permit, testing, insurance inspection, and final erection of field installation is simplified and expedited, thereby saving both time and material—prime factors in our war effort.

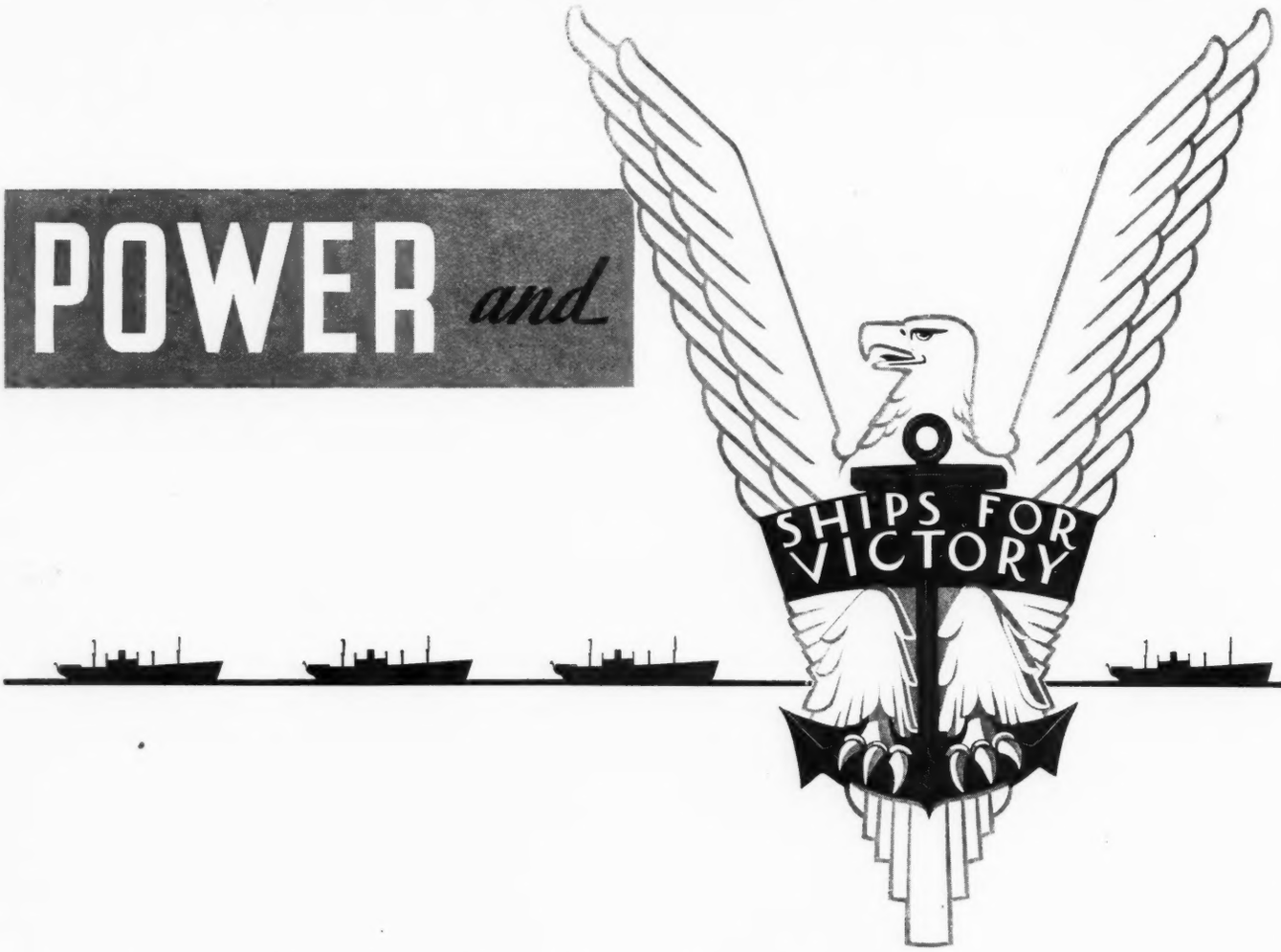
Pittsburgh Piping's experience of nearly 40 years, plus their modern facilities and trained personnel assure prompt, efficient and positive results. If you need a single pipe or complete system, address your nearest Pittsburgh Piping & Equipment Company office listed below.

PITTSBURGH PIPING & EQUIPMENT CO., 10 FORTY-THIRD ST., PITTSBURGH, PA.

Woolworth Building, New York · Occidental Building, Indianapolis · Peoples Gas Building, Chicago · Union Guardian Building, Detroit

Public Square Building, Cleveland · 10 High Street, Boston · 525 Market Street, San Francisco

POWER *and*



"SHIPS, ships and more ships" is a by-word in war production today. Ships we must have in unprecedented numbers and on unheard-of schedules.

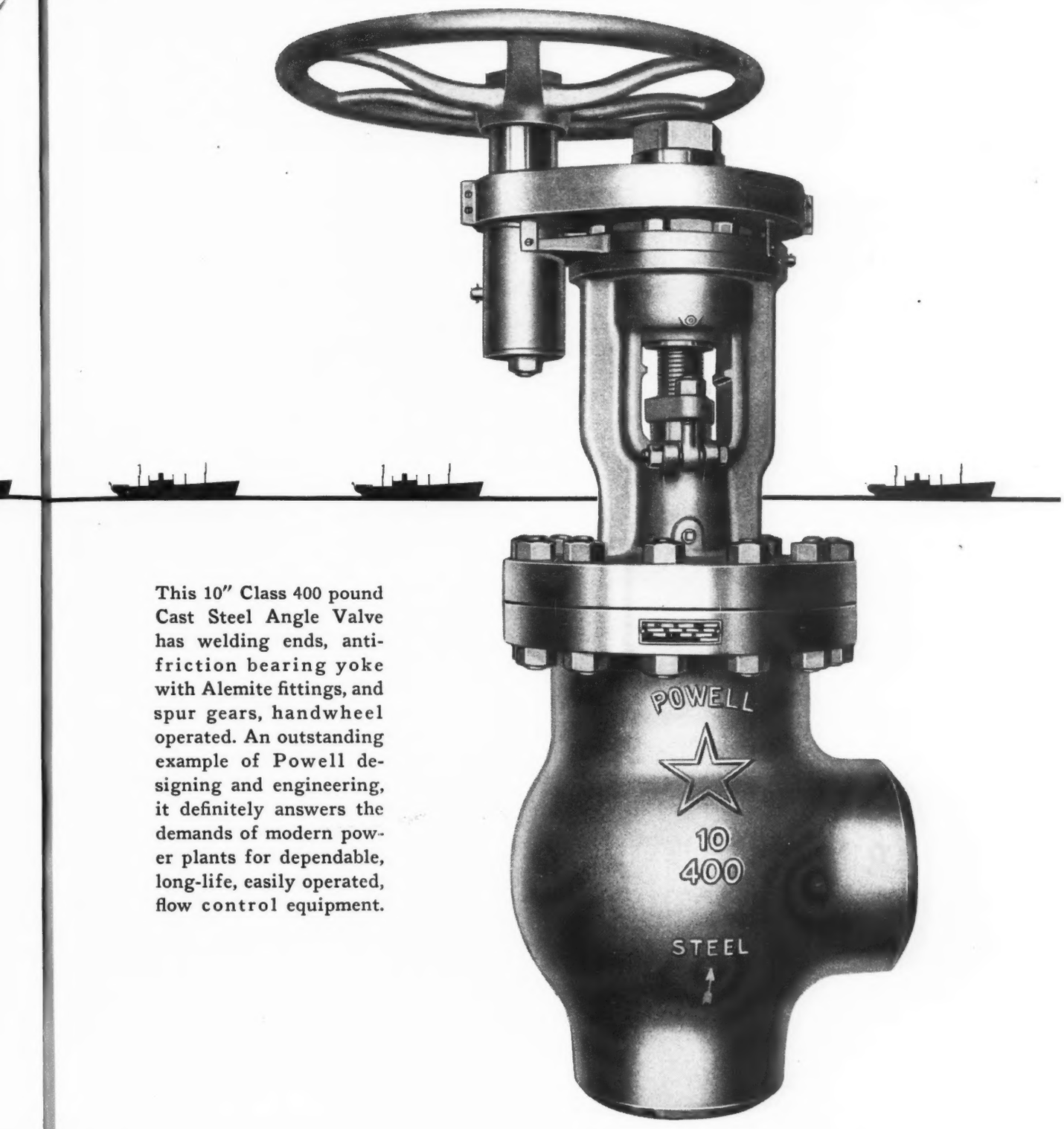
Power we must also have to drive the machines that fabricate the materials from which the ships are built and the many items with which they must be equipped. And we must have valves for the plants that make the power.

Many of these will be Powell Valves. So many, in fact, that the Powell factories are working 'round the clock seven days per week to supply the demand.

We are proud of our participation in the creation of America's War Machine. We are thankful that the years we have spent in building up our enginering and manufacturing facilities may now be turned over to the service of Our Country. We are glad to devote the full time of all of our facilities to the building of valves for the Ships and Power Plants of Victory.

The Wm. Powell Company
Cincinnati, Ohio

POWELL



This 10" Class 400 pound Cast Steel Angle Valve has welding ends, anti-friction bearing yoke with Alemite fittings, and spur gears, handwheel operated. An outstanding example of Powell designing and engineering, it definitely answers the demands of modern power plants for dependable, long-life, easily operated, flow control equipment.

VALVES

The TERRY

TERRY
SOLID WHEEL TURBINE
ADVANTAGES . . .

— The blades and the wheel (see above) are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— As the only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

— The Terry wheel will withstand abuse that would wreck any built up wheel.

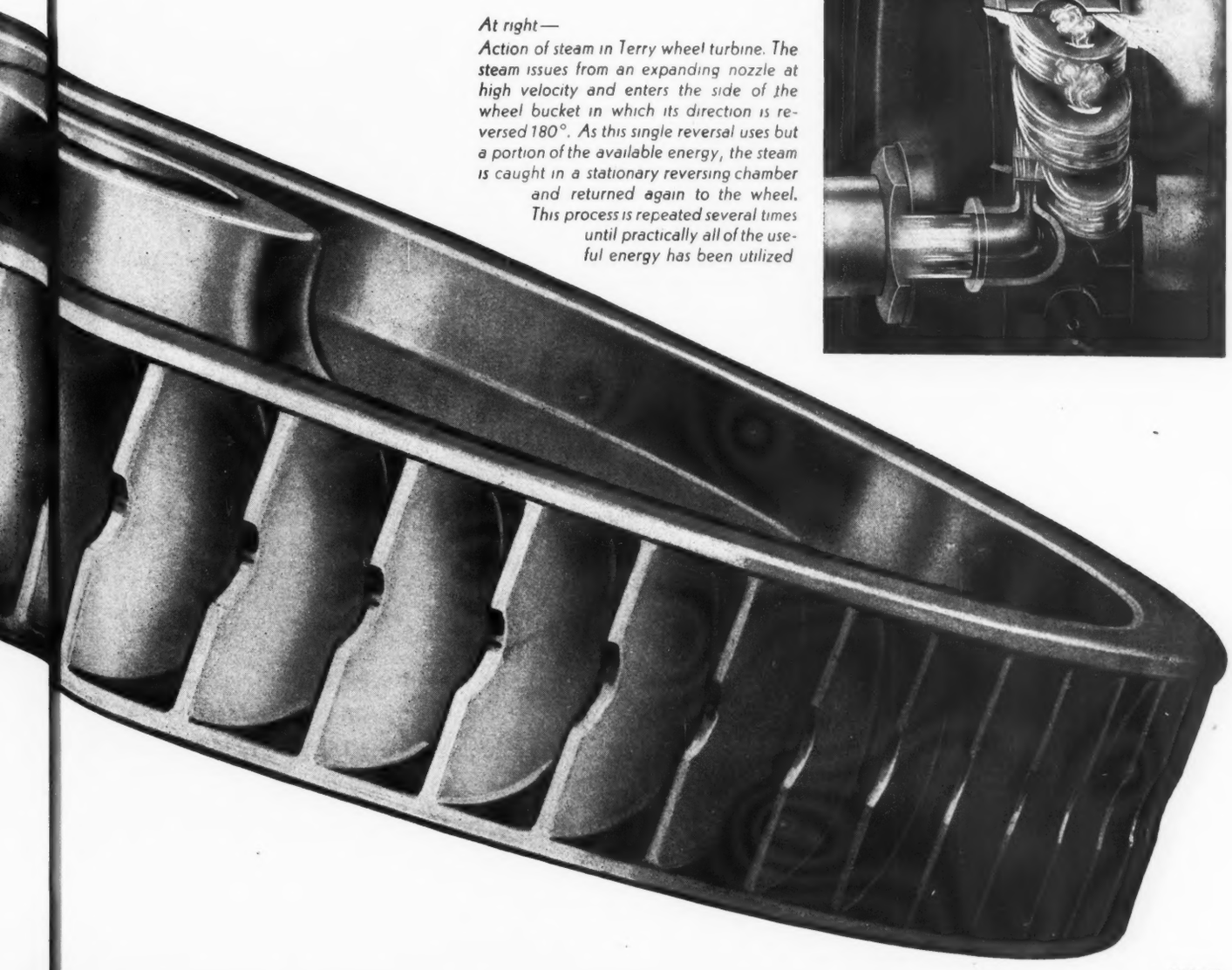
THE TERRY STEAM TURBINE CO.

Wheel Turbine

The Terry Solid Wheel Turbine is available in ratings from 5 HP to 2000 HP. It is built for all commercial steam pressures and exhaust pressures. Thousands of them are in daily service in central stations, industrial plants and on board naval vessels.

Full details of the Terry Solid Wheel Turbine will be gladly sent upon request. Ask for Bulletin S-116.

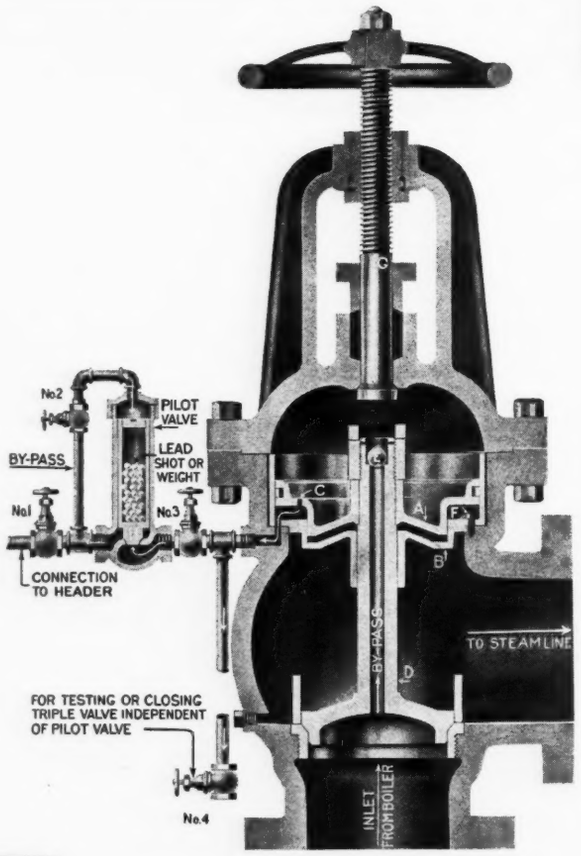
At right—
Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized



T-1147

TERRY SQUARE - HARTFORD, CONN.

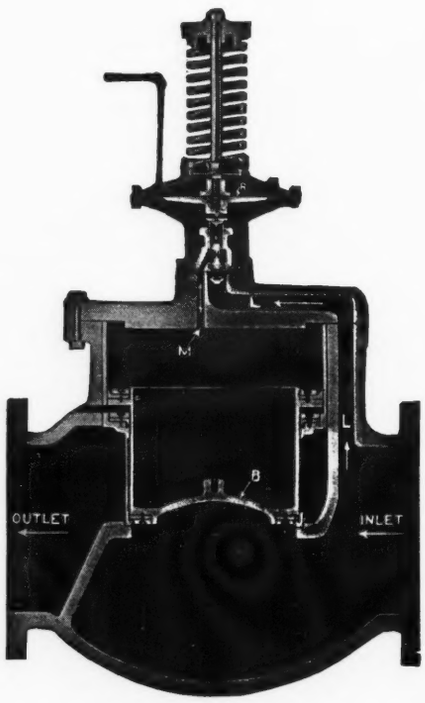
HAS *YOUR* PLANT



1

FOR EXAMPLE—

Suppose a high pressure line is broken, inside the plant, or on an outside line? Suppose a tube blows out in one boiler of a battery? In either case, the steam content of the whole battery will explode through *that broken line*, or through *that ruptured tube* — UNLESS you have the protection of the Golden - Anderson Triple Acting and Non-Return Valve, (shown on left). Here's automatic safety the instant the break occurs. No plant is adequately protected without them.



2

Is your water system protected against

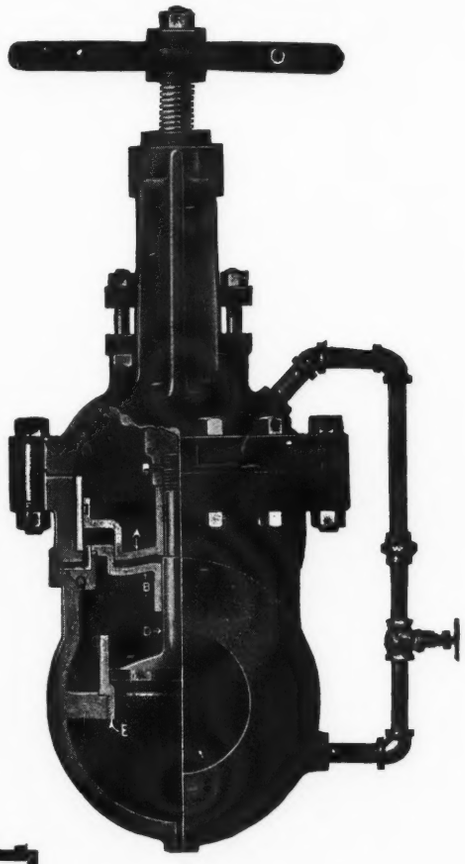
OVERFLOWING TANKS & STANDPIPES?

The Golden-Anderson Standard Altitude Valve, shown on the right is standing guard day and night on tanks and standpipes in every type of industrial plant and control station. It maintains a uniform water level at any set point and a positive check against overflow and waste.

Protecting Life and Property in the Power plant has been a specialty of this Company for nearly 40 years—not as valve manufacturers of a line of valves for all purposes, but only as manufacturers of a special line of "Emergency valves." . . .

GOLDEN-ANDERSON VALVE SPECIALTY CO

TADEQUATE PROTECTION?



3 ***Is your generating equipment protected against***

RUNAWAY TURBINES or ENGINES?

The Golden-Anderson Combined Throttle and Automatic Engine Stop shown on left, is recognized by turbine and engine manufacturers and plant operators, alike as one of the finest designed and most dependable valves of its kind ever built. Automatically closes to runaway engine or turbine. Can also be operated by hand or remote control.

4 ***Are your steam lines protected***

With CONSTANT, UNFAILING PRESSURE?

The Golden-Anderson Steam Pressure Reducing Valve, shown at right, is particularly useful where it is imperative that a low-delivery presssure is to be maintained at all times there is a "dead end" that down-stream pressure will not build up. Here's one reducing valve that will positively hold any adjusted delivery pressure at all times.

With the four "leaders" shown here are included in the G-A line: check valves, float valves, water reducing valves, spray valves, etc.

And with all Golden-Anderson engineering and production centered and concentrated on this special line exclusively Golden-Anderson valves offer the plant operator the very best in valves of these types.

Write for quotations or ask for the new 1942 illustrated catalog

LTY COMPANY FULTON BUILDING **PITTSBURGH, PENNA.**

Airco Apparatus Repair Stations are located in the cities shown above.

HAVE ITS LIFE RENEWED
AT AN AIRCO APPARATUS STATION

New oxyacetylene torches, tips and regulators are becoming more and more difficult to obtain every day. Therefore, it's imperative to make existing apparatus last as long as possible.

Worn or damaged Airco equipment should never be scrapped before it is examined at an Airco Apparatus Repair Station. In most cases it will be repairable—and returned to you, quickly, as good as new.

Avail yourself of Airco's national repair service — staffed by company trained and supervised men. Regardless of your location, there's an Airco Station in your area.

Air Reduction

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y.**

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OFFICES IN ALL PRINCIPAL CITIES

AIRCO WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

Check these advantages of SHAW PREFABRICATED PIPING

for War Plants Producing- EXPLOSIVES- SYNTHETIC RUBBER - 100 OCTANE AVIATION GASOLINE

Since 1893 Benjamin F. Shaw Company has specialized in prefabricated piping.

Years of broad experience are backed by continuous piping research.

In addition to its modern plant, Shaw maintains fully-equipped operating production units right in the field on the job.

Skilled welders and other specialists in piping prefabrication, work under the best shop conditions.

"Shaw prefabricated piping is delivered to the job in a series of sub-assemblies that are accurately tested, alligned, thoroughly cleaned and inspected - all ready for rapid and economical erection."

C. C. Zimmerman

CHIEF ENGINEER

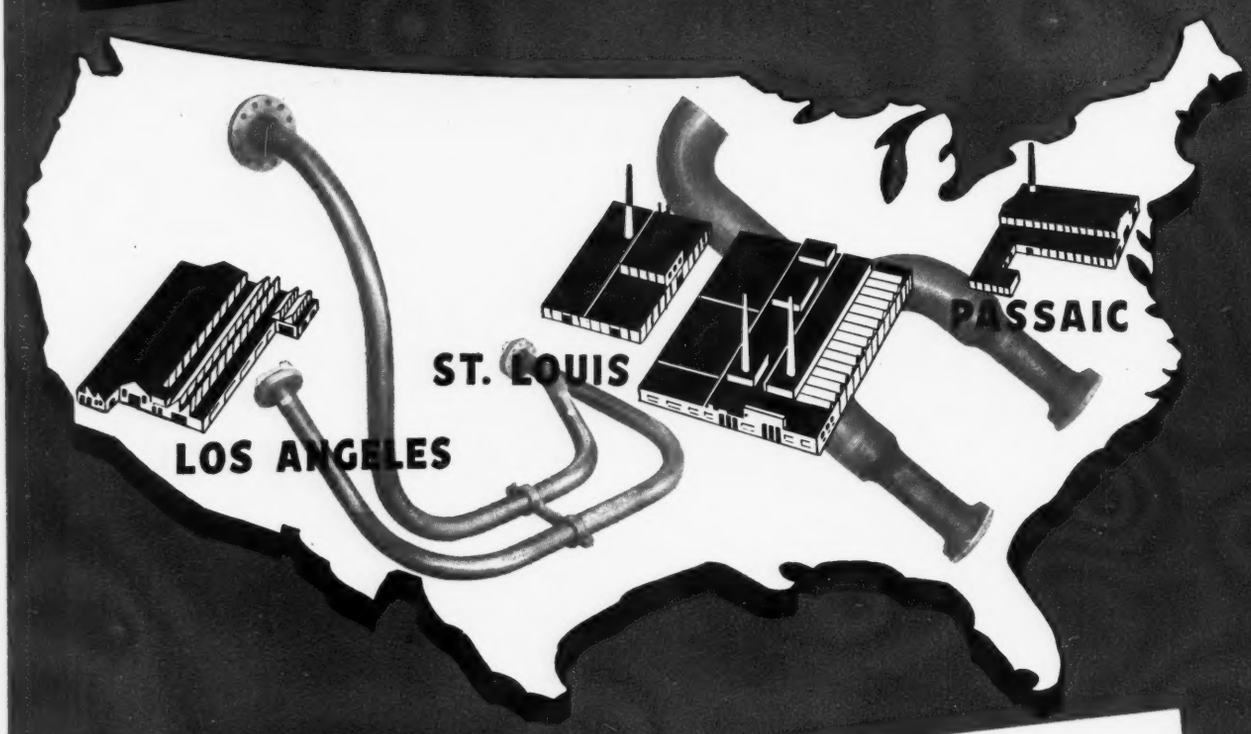
The Shaw Company record of important jobs speaks for itself. We invite your inquiry.

BENJ. F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS, CONTRACTORS AND DISTRIBUTORS

MIDWEST PIPING SERVICE IS NATION-WIDE



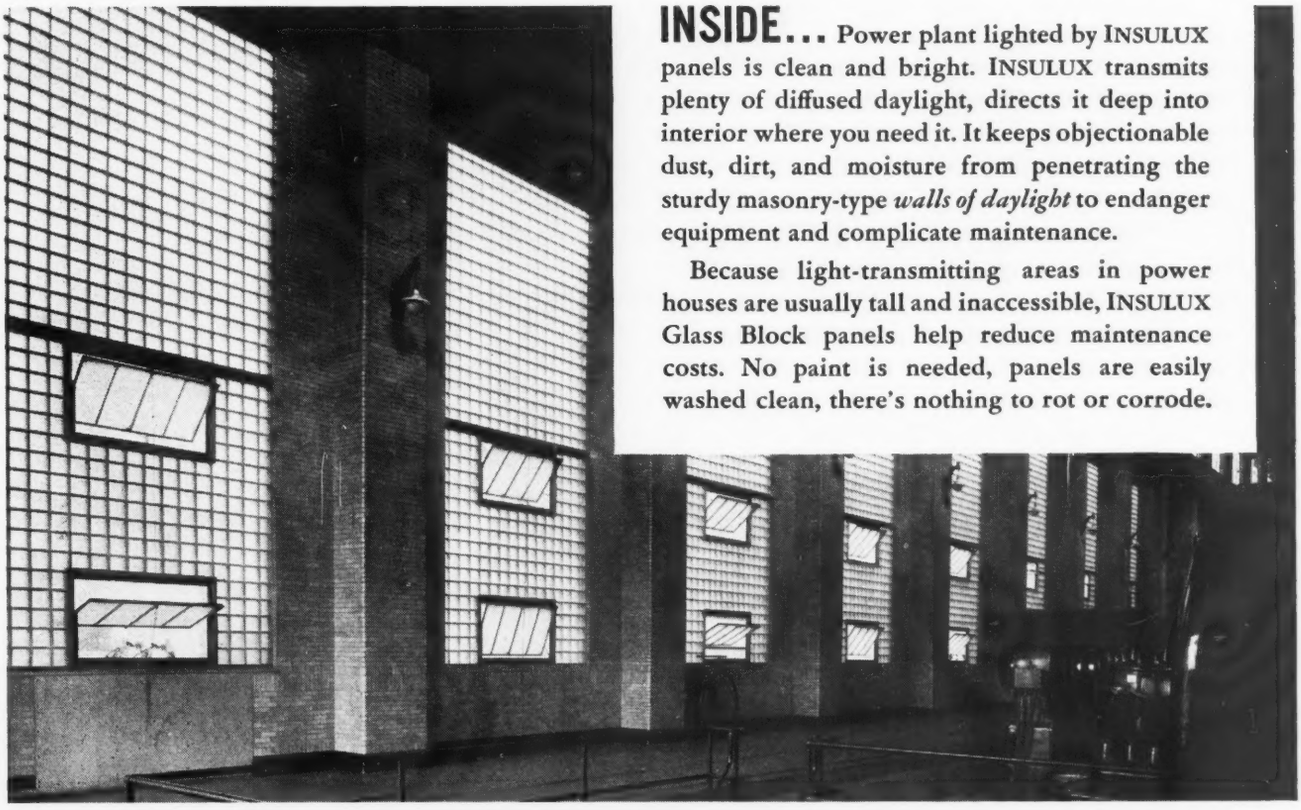
Now . . . that Time is more vital than ever before . . . the strategic locations of the Midwest plants for the fabrication of piping take on added importance. Each Midwest plant is a complete unit . . . provided with the most modern equipment and manned by a highly skilled organization for prefabricating all kinds of power plant and process piping. You will find it definitely advantageous to get in touch with the nearest Midwest office whenever you need fabricated piping . . . whether only a simple pipe bend, a coil or a complete alloy piping job.

MIDWEST PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 So. Second St., St. Louis, Mo. • Plants: St. Louis, Passaic (N. J.) and Los Angeles

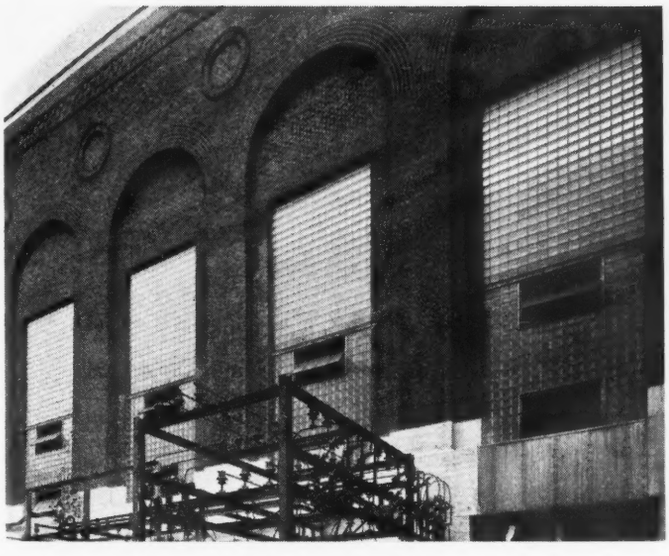
Sales Offices: Chicago—949 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • San Francisco—436 Call Bldg. • Tulsa—533 Mayo Bldg.

Take a Look at Both Sides of a Power Plant with INSULUX *Daylight* Panels



INSIDE... Power plant lighted by INSULUX panels is clean and bright. INSULUX transmits plenty of diffused daylight, directs it deep into interior where you need it. It keeps objectionable dust, dirt, and moisture from penetrating the sturdy masonry-type *walls of daylight* to endanger equipment and complicate maintenance.

Because light-transmitting areas in power houses are usually tall and inaccessible, INSULUX Glass Block panels help reduce maintenance costs. No paint is needed, panels are easily washed clean, there's nothing to rot or corrode.



OUTSIDE... INSULUX Glass Block *protect* power plant operation. Panels are four inches thick and nontransparent—provide full-time vigilance against saboteurs and spies. INSULUX is fireproof—noncombustible. INSULUX permits freedom of design and larger daylighting areas, adding impressiveness to the power plant and the institution it serves.

YOU CAN BUILD AND REMODEL TODAY WITH INSULUX

Only INSULUX, mortar, and little or no metal are needed. Any good bricklayer can install with regular tools. Send the coupon for a new free book of details and pictures. Owens-Illinois Glass Company, INSULUX Products Division, Toledo, Ohio.

OWENS-ILLINOIS

INSULUX

GLASS BLOCK

Fire Prevention Week, Oct. 4-10... Fireproof materials help protect war work

OWENS-ILLINOIS GLASS COMPANY,
INSULUX Products Division, Dept. 69, Ohio Building, Toledo, O.

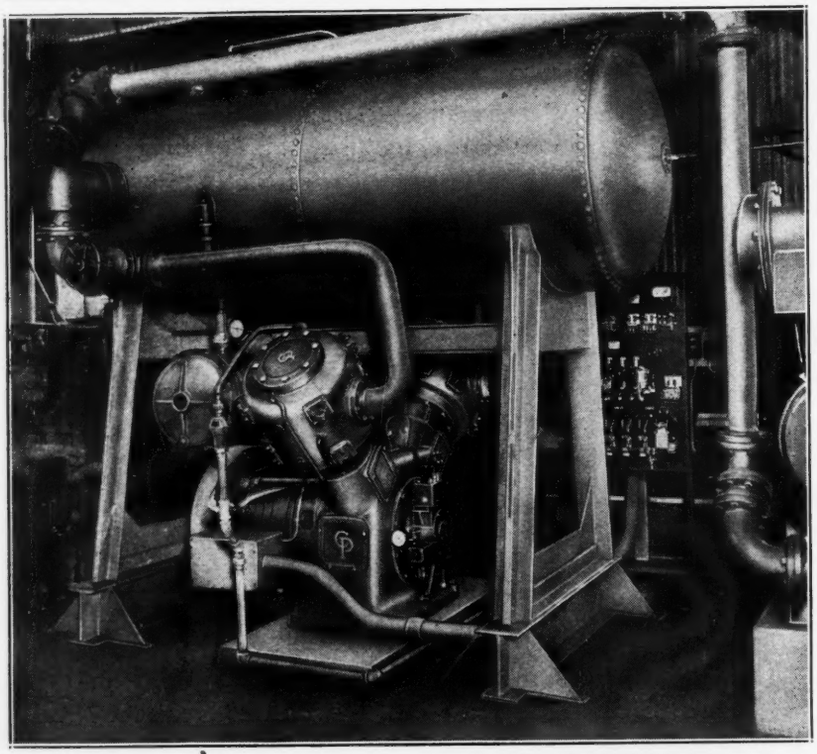
Gentlemen: Please send, without obligation, full information on INSULUX Glass Block.

Name _____

Address _____

City _____ *State* _____

150 HP COMPRESSOR WITH MOTOR, ONLY 7′8″ x 5′0″



CP TYPE Y COMPRESSOR SOLVES PROBLEM OF LIMITED SPACE

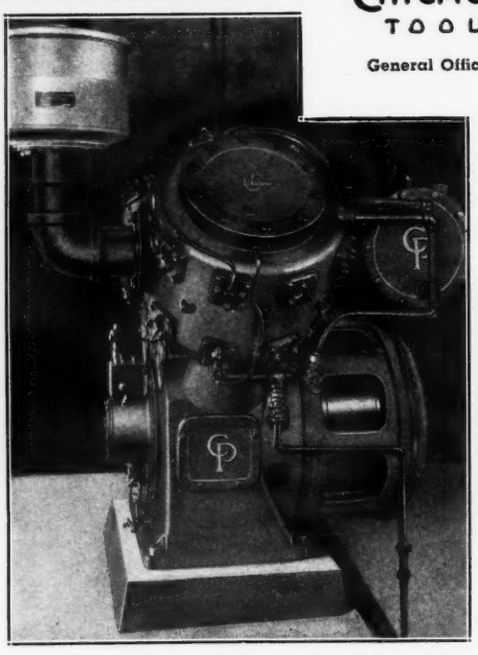
Shipped Intact, Quickly Installed

ALABAMA (CP) — A southern manufacturer had a CP horizontal O-CE air compressor. Production called for more air, but floor space was limited. A CP Type Y two-stage, double-acting 150 h.p. compressor gave him the needed 900 c.f.m. Shipped intact, the CP "Y" was quickly installed and required a space only 7′ 8″ long, 5′ 0″ wide, 5′ 5″ high, including built-in motor. Large valve area, multi-step regulation, effective intercooling and other features, insure efficient, dependable performance.

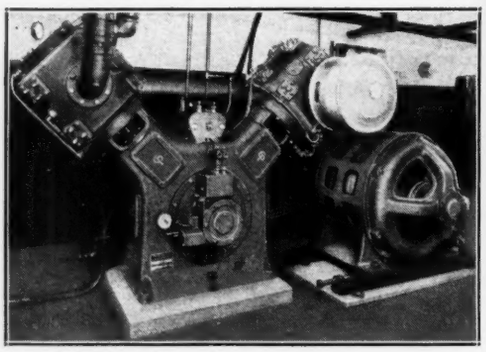
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 E. 44th St., New York, N. Y.

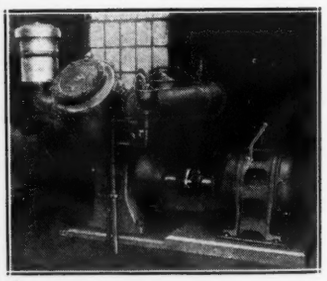
↑ **COMPACT.** This 150 hp. CP Type Y Air Compressor, 900 c.f.m. capacity at 100-125 lbs., with built-in direct-drive synchronous motor, takes less than half the space required by the same capacity horizontal compressor which it supplements. Proportions of compressor permit mounting of air receiver directly overhead.



← **SMALL FLOOR AREA** and simple foundation needed for this CP built-in drive Type Y Air Compressor are clearly shown; as is simplicity of design. Write for Bulletin 766.



↑ **TYPES AND SIZES.** CP Type Y double-acting compressors are available in capacities of 501 to 900 c.f.m. for 100-125 lbs. discharge pressure for sea level service. Sizes for other pressures also available.



↑ **ADAPTABLE TO MANY TYPES** of drives—built-in electric motor, coupled motor (as illustrated) or other prime mover, or belt wheel.

CHICAGO PNEUMATIC

AIR COMPRESSORS

ALSO: Pneumatic Tools, Electric Tools, Rock Drills, Hydraulic Aviation Accessories, Diesel Engines

PORTABLE
STATIONARY
AIR OR GAS
MOTOR DRIVEN
STEAM DRIVEN
DIESEL ENGINE
DRIVEN

By "S-A"

for the U. S. A.

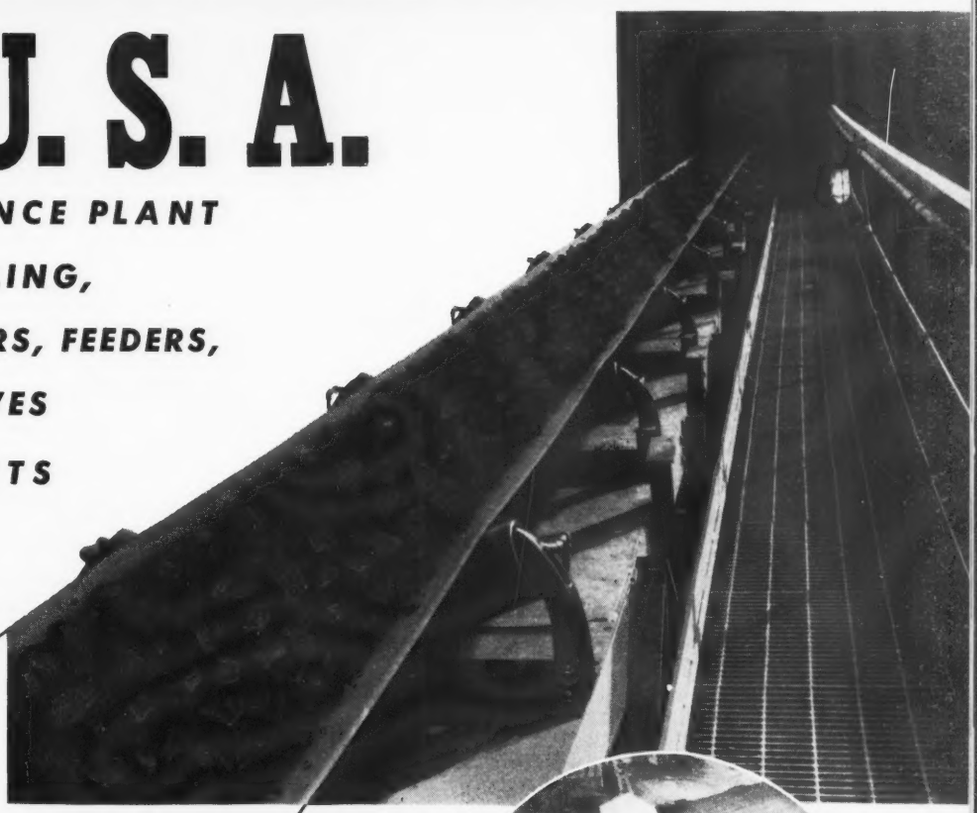
IN THIS HUGE ORDNANCE PLANT

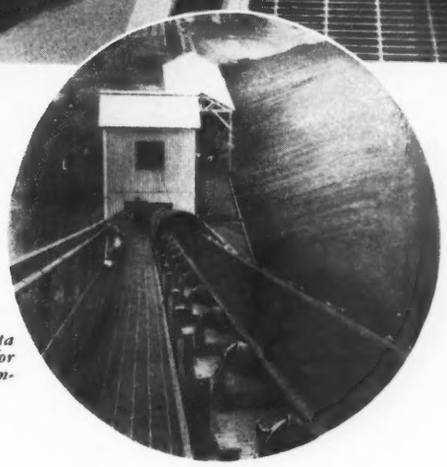
ALL COAL HANDLING,

BELT CONVEYORS, TRIPPERS, FEEDERS,

HOPPERS AND DRIVES

ARE S-A PRODUCTS





● Choice of S-A equipment for jobs like this, with a capacity of 100 tons an hour, emphasizes the quality of engineering built in, by "Stephens-Adamson." Plant or construction engineers, in their turn, make practical combinations of S-A Units adapted to their special needs.

As illustrated here for a plant with auxiliary outdoor storage for 12,000 tons, the coal can be routed at the conveyor junction either to storage piles or plant bunkers. Other features: Automatic recording of tonnage carried by the conveyor—Crushing and distributing coal from storage piles, bedded evenly in bunkers over the boilers.

Write for Engineering Data Bulletins on Equipment for Every Coal and Ash Handling Problem.

STEPHENS-ADAMSON MFG. CO.

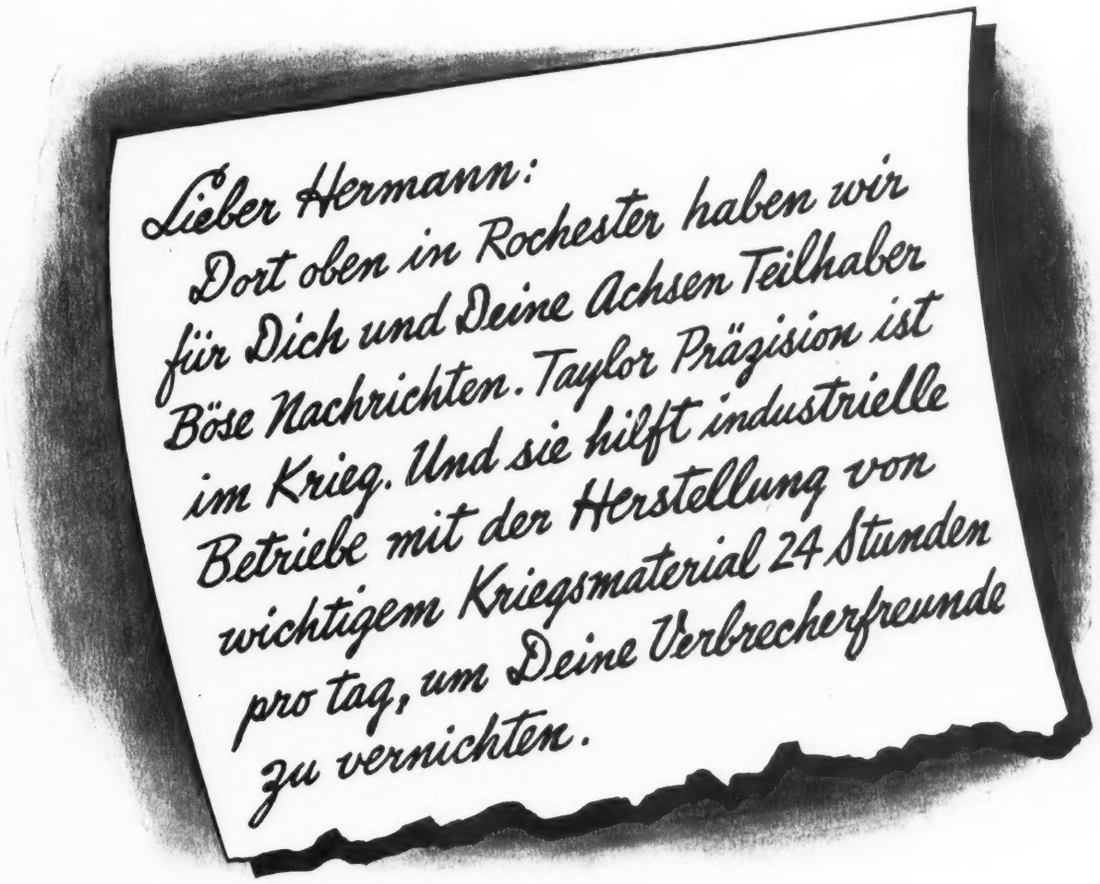
Chains and Sprockets | **Belt Conveyors** | | **Bucket Elevators** | **Crushers**
Bin Gates | **Pan Conveyors** | **SealMaster** | **Feeders** | **Screens**
Speed Reducers | **Redler Conveyors** | **Ball Bearings** | **Skip-Hoists** | **Winches and Car Pullers**

5 Ridgeway Avenue, Aurora, Illinois

Purring like a kitten today—
BUT RUST MAY STRIKE TOMORROW!
Right now rust can be working on the delicate governor mechanisms of your turbines . . . then without warning—trouble! To help prevent costly shutdowns and overhauls change over your turbines to *new* Shell Turbo Oil—it can prevent rust! The first turbine oil to meet all 3 vital requirements of modern turbine lubrication, it offers
RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY
Why accept less? Call in Shell today!
Keep YOUR turbines humming with
SHELL TURBO OIL
SHELL

An open letter TO A NAZI SPY

(who may be planning a certain visit)


Lieber Hermann:
Dort oben in Rochester haben wir
für Dich und Deine Achsen Teilhaber
Böse Nachrichten. Taylor Präzision ist
im Krieg. Und sie hilft industrielle
Betriebe mit der Herstellung von
wichtigem Kriegsmaterial 24 Stunden
pro tag, um Deine Verbrecherfreunde
zu vernichten.

Dear Hermann:

Up in Rochester we've got bad news for you and your Axis partners. *Taylor Accuracy is in the war.* And it's serving industrial plants 24 hours a day in the production of vital war materials to beat your gangster friends.

There isn't anything you can do about it, Hermann. Don't try to find out about Taylor Accuracy unless you want 1600 liberty-loving Americans to run you out of town. They're rough on rats like you.

Why is our slogan, "Taylor Means Accuracy First" bad business for the Axis? Because in the minds of Taylor men there is only one thought—to build the most accurate instruments possible for measuring and controlling temperature, pressure, humidity, rate of flow and liquid level. Instruments so accurate that U. S. war plants will be able to produce guns, tanks, ships, airplanes, gasoline, ammunition, clothes, food and raw materials better and faster than you can. Every Taylor employee is a craftsman who stakes his reputation on the accuracy of the instrument he makes. Every Taylor Field Engineer is honor bound to see that every instrument you buy does its work 100%. That's been true for nearly a hundred years.

This isn't the first time Taylor Accuracy has gone to war. It is helping to win *this* war, and make a better world afterward for every man, woman, and child.

Taylor Instrument Companies
Rochester, N. Y. and Toronto, Canada

Taylor Instruments
MEAN
ACCURACY FIRST
Indicating, Recording, Controlling
TEMPERATURE, PRESSURE, HUMIDITY, FLOW AND LIQUID LEVEL

TO AMERICANS ON THE HOME FRONT: *Taylor Household Thermometers and Weather Instruments have enlisted for the duration. Most stores still have stocks on hand. If yours hasn't, remember — Taylor's war experience will bring you even better instruments later!*

★ ★ ★ **KEEP ON BUYING U. S. WAR SAVINGS BONDS AND STAMPS** ★ ★ ★

REVALON

Is the sea your friend or foe?

By furnishing an inexhaustible supply of cooling water for condensers, the sea can be a trusted friend of the power plant engineer. But by attacking the scarce, strategic metals in condenser tubes, salt or brackish water at high velocities can become one of your worst enemies—especially now when there is a critical shortage of materials.

Central power stations can use the sea as a friend by equipping condensers with tubes of Revalon (aluminum brass) by Revere. For this improved alloy is highly resistant to corrosion and erosion alike.

Revere metallurgists have developed the art of incorporating aluminum successfully into copper-base alloys to produce sound aluminum brass. The outstanding characteristic of Revalon is its property of forming a tough, tenacious, self-healing film which gives the tube great resistance to impingement attack from high velocity salt water.

Revere tubes are made by an extrusion process from solid cylindrical castings. By this method any internal casting defects, which tend to concentrate in the center of the casting, are automatically rejected through the removal of a central plug of metal prior to extrusion.

Likewise, any sub-surface imperfections or inclusions are left behind in the "skin" of metal remaining in the container after extrusion of the tube itself. The result is a tube of unusual mechanical soundness.

Revere condenser tubes and condenser tube plates are available in a number of alloys to meet every requirement of industry. The Revere Technical Advisory Staff is always ready to help with your problems. Call Revere.

REVERE

COPPER AND BRASS INCORPORATED

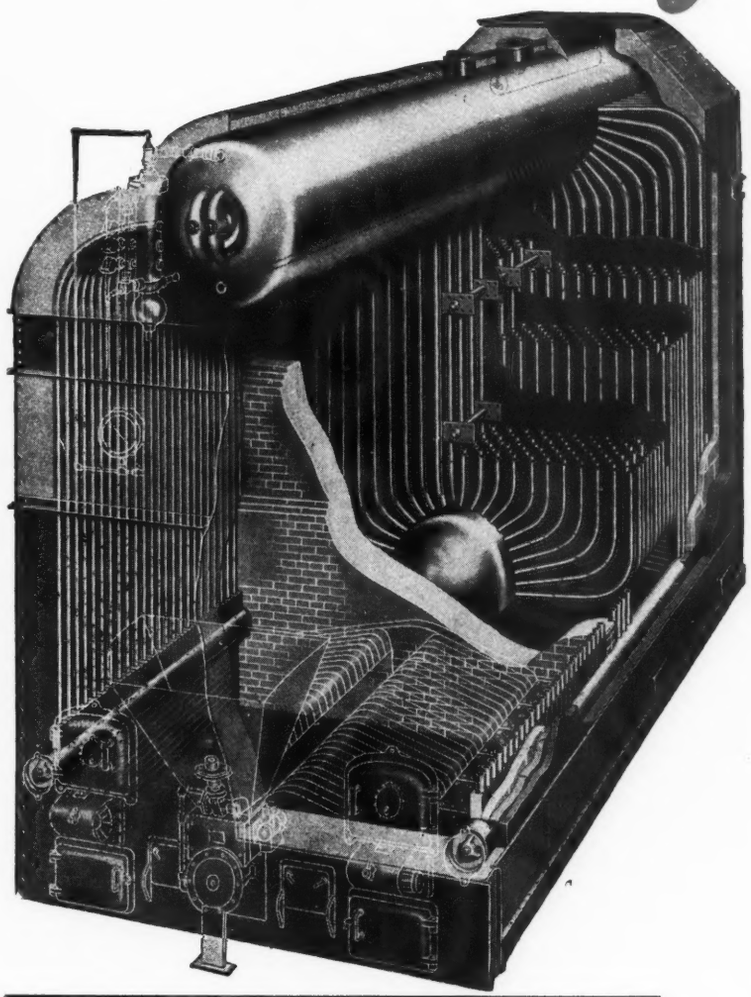
Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York

Sales Offices and Distributors in Most of America's Major Cities

TWO REVERE PLANTS HAVE RECEIVED THE NAVY "E" AWARD FOR EXCELLENCE IN WAR PRODUCTION

Don't Buy Now!



Unless:

1 You are engaged in essential war production,

2 Your present equipment is inadequate,

3 You desire to operate more efficiently,

4 to lose less time for repairs,

5 to spend less money for maintenance,

6 to get more capacity in a given space,

7 to handle overloads when they occur.

All of these advantages can be obtained by the use of the Keeler C P steam generator, over eight hundred of which are now in use, serving important industries and institutions throughout the United States and Canada.

Capacities to 100000# per hour
Pressures 125# p.s.i. to 500# p.s.i.
Suitable for firing with stokers, pulverizers, oil, gas, bagasse, hogged fuel or waste heat.

(Manufactured in Canada by Canadian Vickers, Ltd., Montreal)

E. KEELER CO.
BUILDERS OF BETTER BOILERS SINCE 1864
WILLIAMSPORT, PENNA.

E. KEELER CO., WILLIAMSPORT, PENNA.

Send copy of Bulletin F9-2 to

NAME .....

TITLE .....

FIRM .....

ADDRESS .....

RODA — High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE — Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER — Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiralty Coal — Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky — Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

GENCO — Steam and domestic coals from a number of producing districts.

ANTHRACITE — Premium and standard qualities in the entire range of Anthracite burning characteristics.

Capable engineering personnel and the experience gained through long and varied marketing activity assures proper application of one of the above brands and effective servicing of any fuel requirement.

General Coal Company

123 SOUTH BROAD STREET — **PHILADELPHIA, PA.**

Branches

BLUEFIELD, W. VA.
BOSTON
BUFFALO
CHARLESTON
CHARLOTTE, N. C.
CINCINNATI
DETROIT
NEW YORK
NORFOLK
PITTSBURGH

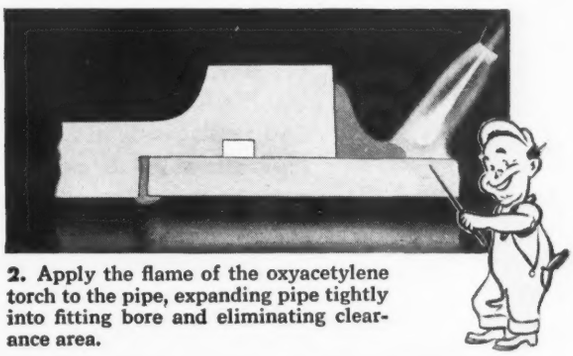
HOW TO INSTALL SILBRAZ JOINTS

USING WALSEAL VALVES AND FITTINGS

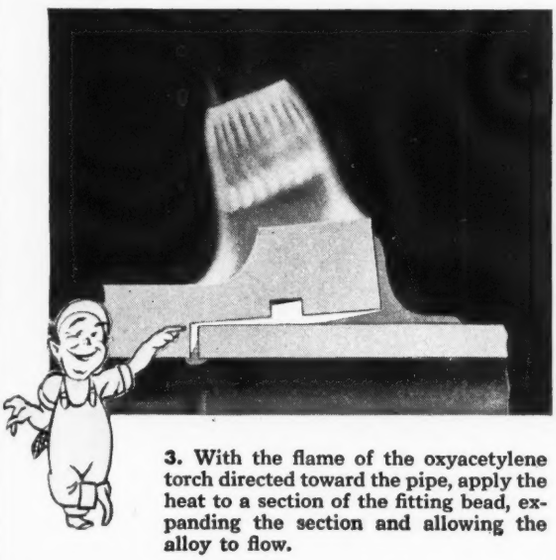
Walseal Valves and Fittings actually make a "one-piece" pipe line when connected by Silbraz joints to copper or brass pipe, copper or copper-nickel tubing. The Silbraz joint cannot creep or pull apart under any temperature or pressure conditions to which the pipe or tubing can be safely subjected. Shock and vibration do not affect it; in fact, the Silbraz joints are the strongest parts of the piping system.

A Silbraz joint is a silver brazed joint —not a soldered joint.

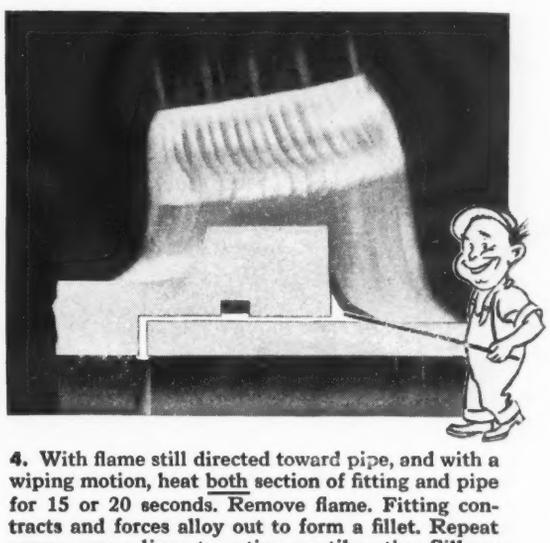
1. After cleaning and fluxing both pipe end and fitting bore, slip pipe into fitting up to shoulder. (Gray indicates flux; white indicates brazing alloy.)



2. Apply the flame of the oxyacetylene torch to the pipe, expanding pipe tightly into fitting bore and eliminating clearance area.



3. With the flame of the oxyacetylene torch directed toward the pipe, apply the heat to a section of the fitting bead, expanding the section and allowing the alloy to flow.



4. With flame still directed toward pipe, and with a wiping motion, heat <u>both</u> section of fitting and pipe for 15 or 20 seconds. Remove flame. Fitting contracts and forces alloy out to form a fillet. Repeat process on adjacent sections until entire Silbraz joint is completed.

THIS IS OUR CENTENNIAL YEAR

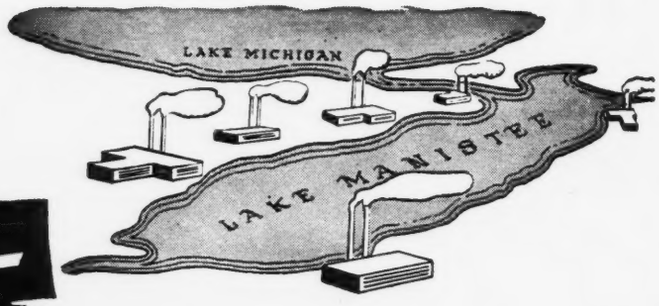
This advertisement is a continuation of Walworth's effort to help users of valves, fittings, flanges, and pipe, obtain the maximum benefits from Walworth products, but we would like you to remember that *Walworth has <u>continuously</u> manufactured valves and fittings for 100 years.*

WALWORTH

VALVES FITTINGS and TOOLS
Backed by 100 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

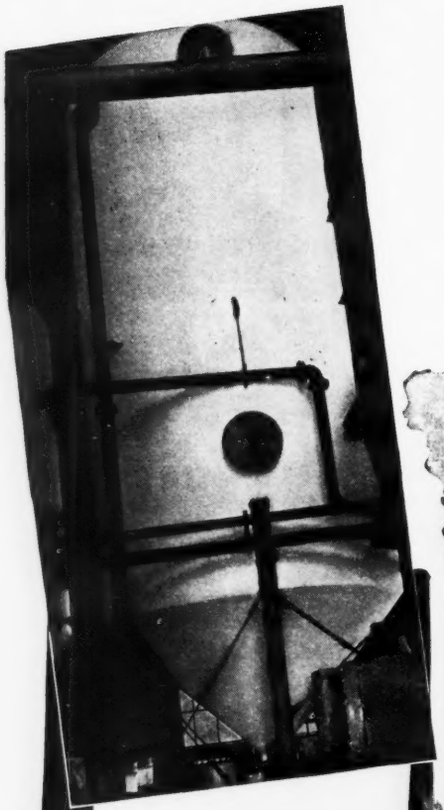
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



Every time the Wind Changes—

a different raw water to treat

The plant of the Filer Fibre Company at Filer City, Michigan, depends upon Lake Manistee for its raw water supply. Six industrial plants empty various kinds of industrial waste into this lake with the result that there is a different water condition to meet every time the wind changes direction.



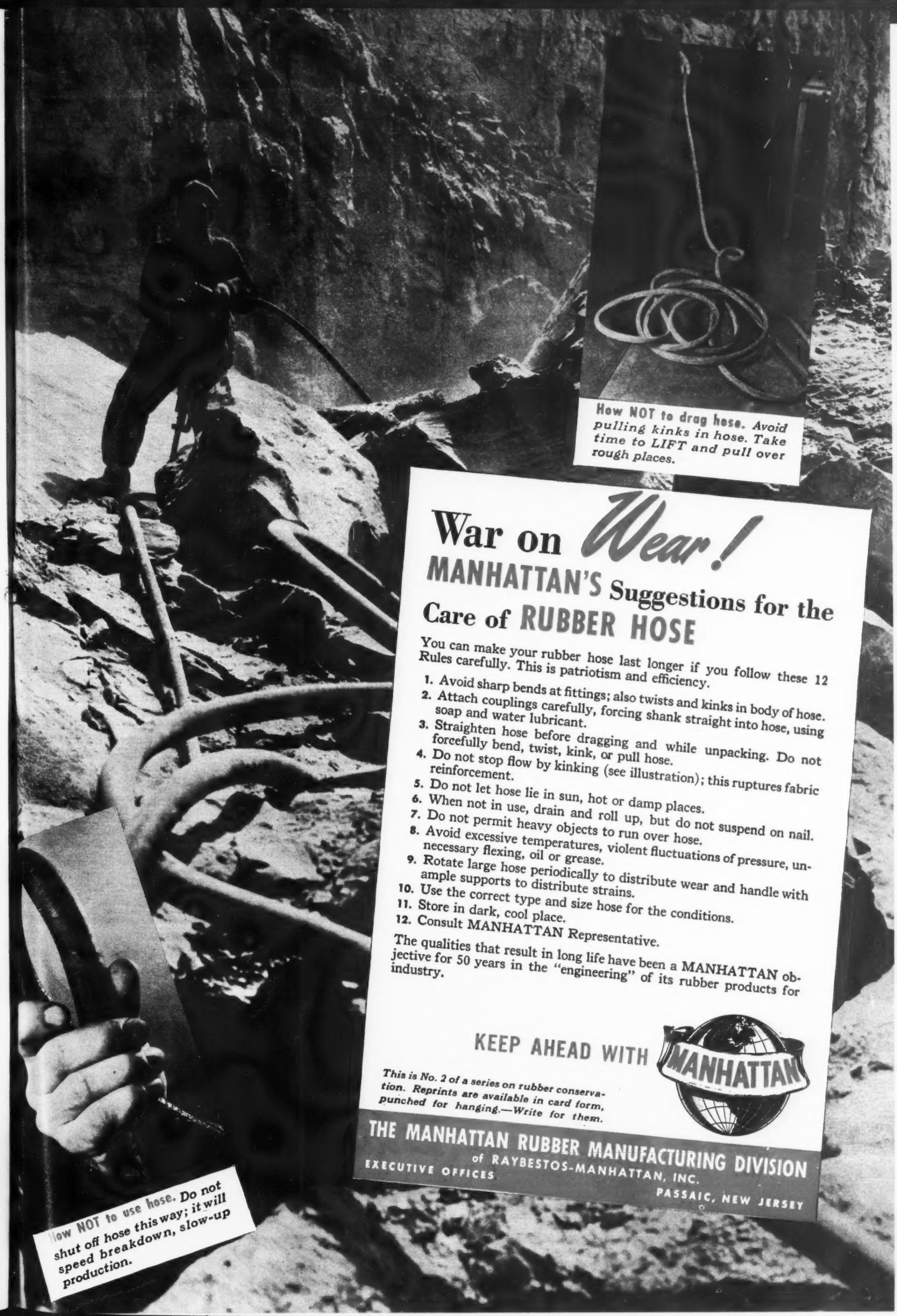
To meet these varying conditions and provide properly treated boiler feed water for the production of 3,350,000 lbs. of steam per day, a Graver Hot Process Water Softening System was installed, including preheaters, settling tanks, mixing tanks, and pressure filters. A Graver Chemical Proportioner controls the flow of chemicals into the softener tank in exact ratio to the volume of raw water being treated. Tests of the treated water are made every two hours and the proportions of chemicals used in the mix can be changed instantly to meet any variation shown by these tests.

After 16 months of operation, Filer Fibre Co. reports as follows: *"Besides improving operating efficiency and providing better average water conditions in our boilers, this system has reduced chemical costs by more than* 50%."

This story is typical of hundreds of water conditioning problems solved by Graver during the past 30 years. Remember, Graver designs, builds, and installs water conditioning equipment *of all types* to meet your individual needs. Let us tell you more about our complete service. Write to Graver Tank & Mfg. Co., Inc., 4809-7 Tod Avenue, East Chicago, Indiana.

GRAVER *Water Conditioning Equipment*

42-44-W



How NOT to drag hose. Avoid pulling kinks in hose. Take time to LIFT and pull over rough places.

War on *Wear!*

MANHATTAN'S Suggestions for the Care of RUBBER HOSE

You can make your rubber hose last longer if you follow these 12 Rules carefully. This is patriotism and efficiency.

1. Avoid sharp bends at fittings; also twists and kinks in body of hose.
2. Attach couplings carefully, forcing shank straight into hose, using soap and water lubricant.
3. Straighten hose before dragging and while unpacking. Do not forcefully bend, twist, kink, or pull hose.
4. Do not stop flow by kinking (see illustration); this ruptures fabric reinforcement.
5. Do not let hose lie in sun, hot or damp places.
6. When not in use, drain and roll up, but do not suspend on nail.
7. Do not permit heavy objects to run over hose.
8. Avoid excessive temperatures, violent fluctuations of pressure, unnecessary flexing, oil or grease.
9. Rotate large hose periodically to distribute wear and handle with ample supports to distribute strains.
10. Use the correct type and size hose for the conditions.
11. Store in dark, cool place.
12. Consult MANHATTAN Representative.

The qualities that result in long life have been a MANHATTAN objective for 50 years in the "engineering" of its rubber products for industry.

KEEP AHEAD WITH MANHATTAN

This is No. 2 of a series on rubber conservation. Reprints are available in card form, punched for hanging.—Write for them.

THE MANHATTAN RUBBER MANUFACTURING DIVISION
of RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES
PASSAIC, NEW JERSEY

How NOT to use hose. Do not shut off hose this way; it will speed breakdown, slow-up production.

"Here's how you can spot the 'criminals' that steal wire rope life...

Look for them regularly... to save your time and money... and America's steel

"IF YOU WANT to get every hour of safe service that's built into your ropes, tell your maintenance men to get up on the cranes and shovels regularly . . . up where the wire rope operates. Tell them how to inspect it . . . how to look for the clues to what is damaging your wire rope and how to establish *your own standards* for deciding when it's necessary and economical to replace your wire ropes.

As a first step, tell them a rope should be judged by the condition of the most severely damaged lay . . . one rope lay being that length of rope in which one strand makes one complete revolution around the rope...

And to select the worst lay, make a counting of the broken wires. Watch to see if the breaks are concentrated in one or two strands. If this is the case, the rope will be considerably weaker than if they are evenly distributed.

You'll probably find some breaks caused by *Abrasion.* In extreme cases they look like this . . .

and even when not worn through, any removal of metal due to wear weakens the rope in direct proportion Abrasion breaks occur most frequently where rope goes over sheaves and drums.

There may be breaks caused by *Fatigue* which look like this . . .

and occur where the rope has been bent around too small a radius too often or has been subject to vibration or whipping. Fatigue breaks also occur after the wire has been damaged by *Corrosion* which shows up as pitting on the surface of the wire. Improper lubrication is to blame and contributes to tension and abrasion as well.

There may be breaks caused by *Mechanical Abuse.* This cut or gouged wire is one example . . .

Careless handling during installation or an accident on the job may cause cut wires like this or mashed wires with flattened or spread ends. Mechanical abuse sometimes may so weaken the wire that it will fail in tension.

Finally, if there are breaks caused by *Tension* they will look like this . . .

And will show one side of the broken wire cupped and the other coned. Tension breaks are always caused by an overload on the wires, which may or may not have been weakened by abrasive wear, by corrosion, or by mechanical abuse. When tension breaks are found, it is usually obvious that the rope is unfit for further duty and in any event should be discarded.

As a last step, have a record kept of the condition and the service life of each wire rope, cut out the worst section when the rope is taken off and send it on to the manufacturer for an ultimate strength test. This will complete your inspection record and form a basis for future inspection and condemnation decisions.

Then, you'll be on the way to getting the maximum useful rope life built into every inch of Roebling "Blue Center" Steel Wire Rope—without taking chances on untimely and dangerous breakdown of equipment vital to wartime production schedules."

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

★ PROMPT SERVICE
★ on essential orders
★ from warehouse
★ stocks or mill

ROEBLING
"Blue Center"
STEEL WIRE ROPE
PREFORMED OR NON-PREFORMED

Expert installation assures longer life from your super refractories

THE maximum service from your super refractories can be obtained only by proper installation.

Since there are no rule-of-thumb methods that can be followed in all cases with any reasonable degree of satisfaction, each installation must be considered separately on its own unique requirements. Each boiler furnace, heat treating unit, gas generator, roaster or retort furnace, for example, presents different problems requiring individual solutions to assure greatest longevity and reliability of service from the refractories.

And right here our refractories engineers can assist you. They have had years of experience with the application of super refractories to practically every kind of furnace and kiln. With this background they know what installation methods will result in the longest service from these materials in your equipment.

The benefit of their experience is yours for the asking. A letter will receive our immediate attention.

REFRACTORY CARBORUNDUM PRODUCTS

Refractory Division

THE CARBORUNDUM COMPANY, PERTH AMBOY, N. J.

REG. U. S. PAT. OFF.

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research development and operating experience by the affiliated Cottrell Companies throughout the world is incorporated in the

COTTRELL INSTALLATIONS

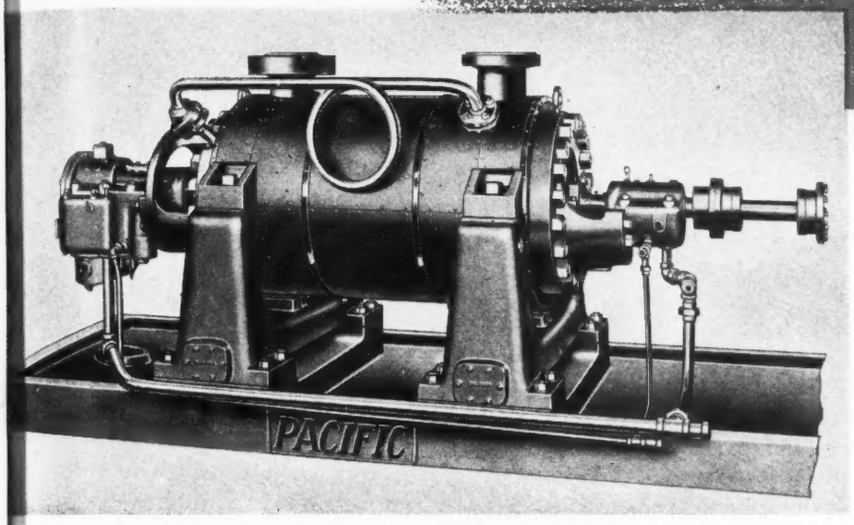
offered to meet the requirements
of any problem by

RESEARCH CORPORATION

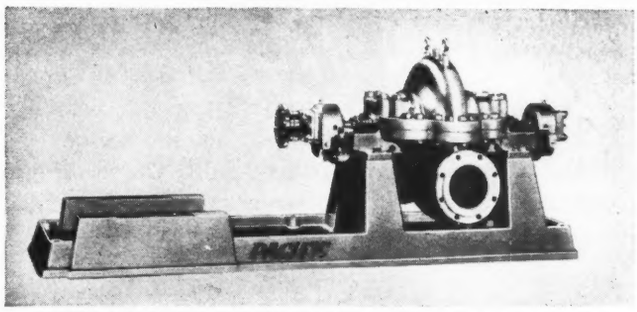
405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
CHICAGO, ILL.

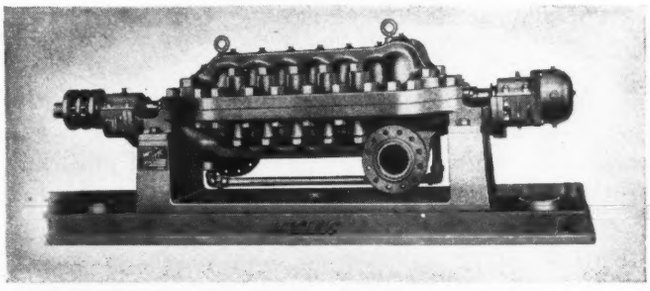
IF YOU WANT ACTION CALL PACIFIC



PACIFIC Type I
Boiler Feed Pump installed by a leading Mid-West Utility.



PACIFIC Type KH—Single-Stage Horizontally Split-Shell Boiler Feed Pump installed by a major refinery.



PACIFIC Type JH—7-Stage Boiler Feed Pump installed by the city of Pasadena, California.

Here at Pacific Pump Works we are prepared to give you *action* not apologies. We can help you determine the particular type of Pacific Pump designed and engineered to give you efficient, dependable service. We can build and deliver your Pacific Boiler Feed Pumps in a reasonable length of time.

You benefit in two ways. First, because Pacific Pumps are designed and tested to meet far greater operating conditions than will be met in actual service. Second, Pacific Pump proved mechanical features protect you against the hazards of operating failures and possible shut down.

If it's *action* you want call, write or wire PACIFIC PUMP WORKS, Huntington Park, California.

PACIFIC PUMP WORKS

EXECUTIVE OFFICES & PLANT: HUNTINGTON PARK, CALIF.
EXPORT OFFICE:
30 ROCKFELLER PLAZA, NEW YORK CITY

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES

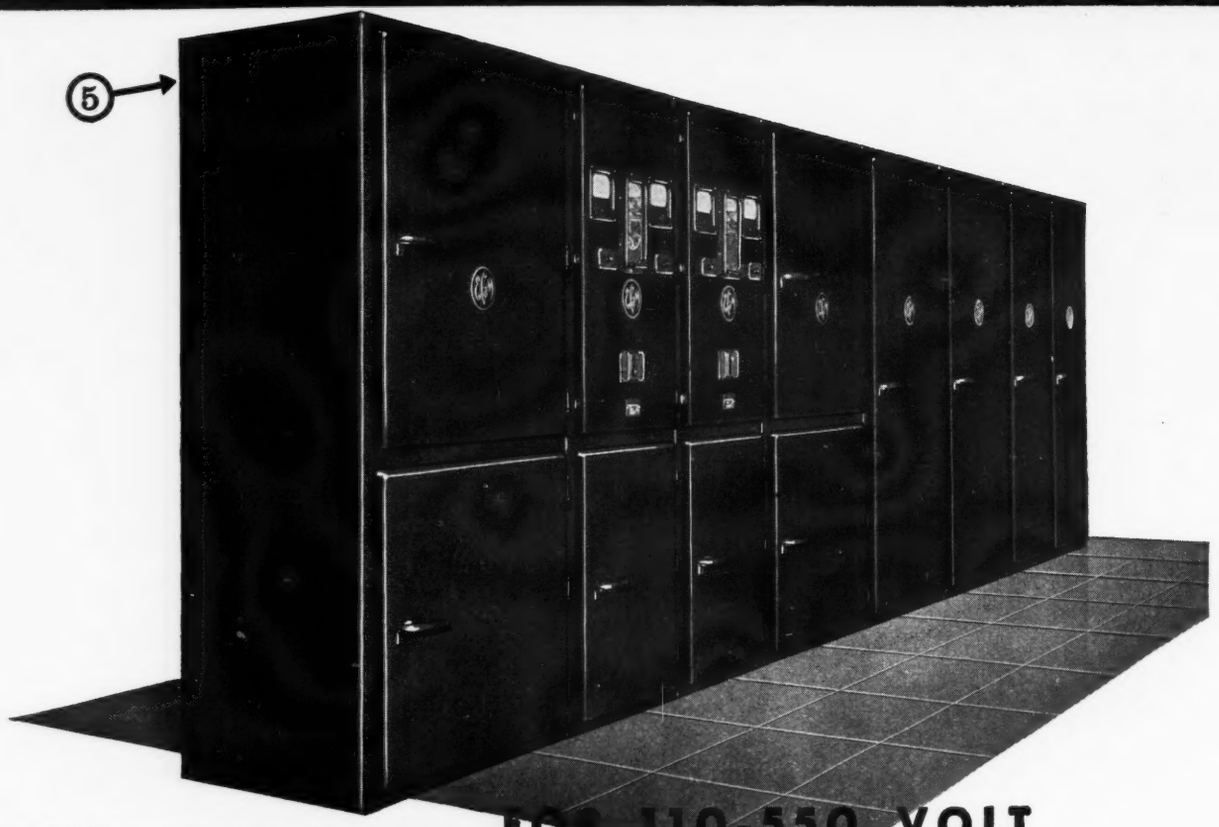
Affiliated Companies: Clark Bros Co., Olean, N.Y., Dresser Manufacturing Co., Bradford, Pa., The Bryant Heater Co., Cleveland, Ohio

"YOU CAN'T BUY A BETTER PUMP THAN PACIFIC"

PACIFIC PUMP WORKS
PACIFIC
HUNTINGTON PARK CALIF

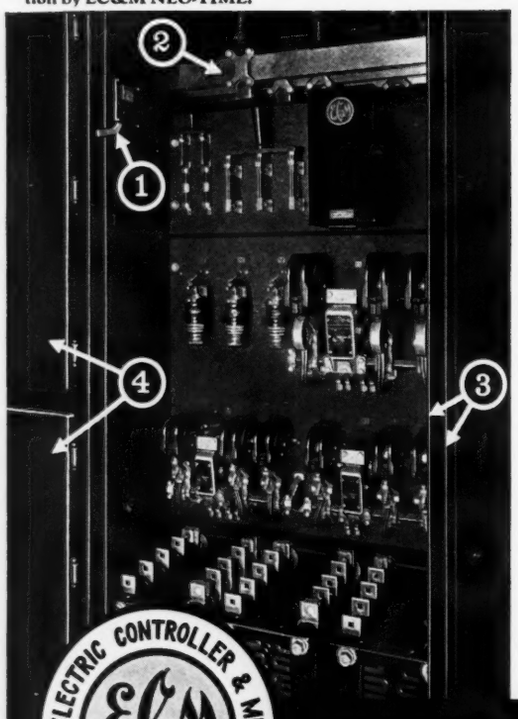
PACIFIC *Boiler Feed* PUMPS

EC&M *Steel-Clad* MOTOR CONTROL



● *Above:* Cubicle control units consisting of two incoming line panels and starter units for six low voltage motors.

● *Below:* Close-up view of a primary-resistor type starter for 150 h.p., 440 volt squirrel-cage motor, with acceleration by EC&M NEO-TIME.



FOR 110-550 VOLT *Squirrel Cage* MOTORS

This control comes completely wired, hence is quickly installed. It is actually custom-built, yet so designed and constructed that additional units can be easily added when needed.

It offers many outstanding features, among which are:

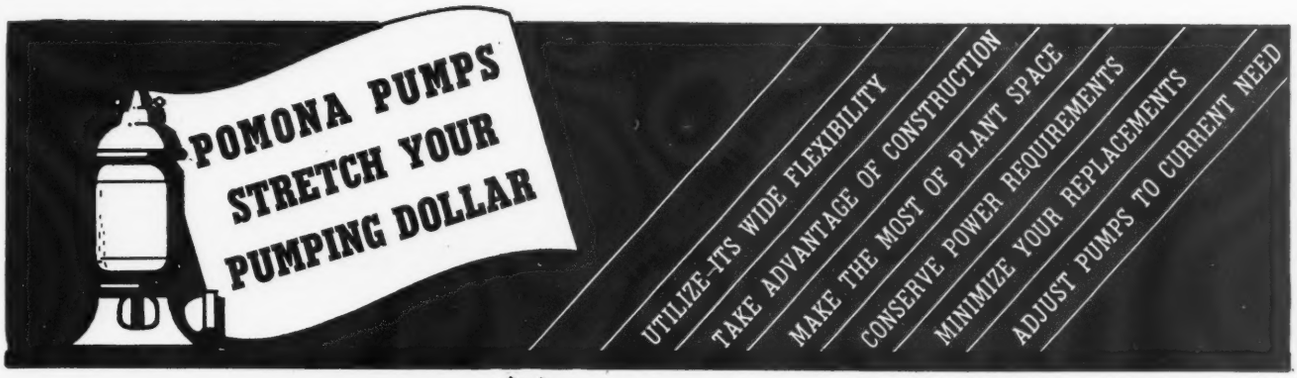
1. Safety interlocks on all starter units.
2. Self-contained bus between units when arranged for group installation.
3. Semi-dust-tite enclosure (NEMA Type 1A).
4. Utmost accessibility through front doors and rear plates.
5. Removable plate on end unit for bus extension when adding units for a group installation.

Today, EC&M Steel-clad Motor Control Units are in use practically everywhere . . . in steel mills, coal mines, refineries, municipal pumping stations, industrial plants, etc. Being totally enclosed and shock-proof, they offer important protection to workmen. Full details are contained in 16-page illustrated Booklet No. 67. Copy upon request.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

THE ELECTRIC CONTROLLER & MFG. CO.

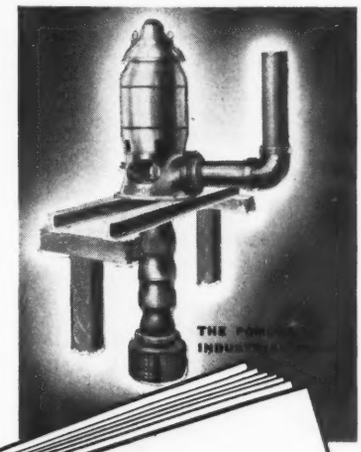
CLEVELAND ★ OHIO



(A Message to Pomona Pump Owners)

YOUR POMONA PUMP IS BUILT FOR OUTSTANDING PERFORMANCE. KNOW ITS MANY FINE FEATURES!

In these times you can be *doubly* thankful you own a Pomona Pump. For in your Pomona you have the best possible pumping equipment with which to weather the present emergency. You have a pump that is extremely simple in construction... a pump so flexible it can be quickly and easily adapted to handle practically *any* type pumping operation that comes along... a pump that requires practically no maintenance... a pump that cuts power bills to the bone. In short, you have a pump that can be used for a wide variety of jobs, that will *keep* pumping far longer, with minimum servicing, at lowest over-all operating cost—*all important considerations in these times.*



But, to take the *fullest* advantage of the many practical performance features built into your Pomona, first make sure you *know* all about your pump. There may be features in your Pomona you didn't know about, or have forgotten about . . . features you can use to even better advantage and thus obtain still *greater* service from your investment in a Pomona!

"Stretching Your Pumping Dollar"—a helpful manual on pump application and operation—has been compiled to assist you in getting topmost efficiency from your Pomona Pump. This booklet will gladly be sent on request. Write today!

POMONA
Water-Lubricated
PUMPS

THREE PROTECTIONS *for Your Investment*

BUILT INTO EVERY PRITCHARD TOWER

PRITCHARD ATMOSPHERIC TOWERS have all the rugged construction, liberal safety factors and low pressure water distribution of mechanical draft types. They are designed with or without auxiliary cooling coils and are featured by deck level air flow and retriever type drift control.

1. Rugged Construction, like the tower above, made of heart redwood with heavily reinforced bolted frame, tongued and grooved double sheathing.

2. "Featherweight" Monel Fans that don't pit or corrode . . weigh half as much as ordinary fans . . move more air per horsepower . . reduce driving equipment wear.

3. Full Rated Capacity and other liberal safety factors that mean efficient, economical operation under continued peak loads when many towers fail.

Some of the largest orders ever placed for water cooling equipment have been for Pritchard cooling towers.

J. F. PRITCHARD & COMPANY
FIDELITY BUILDING, KANSAS CITY, MISSOURI
BRANCH OFFICES IN TULSA, OKLA.; HOUSTON, TEXAS; ATLANTA, GA.
CHICAGO, ILL.; PITTSBURGH, PA.; NEW YORK CITY

PRITCHARD
Atmospheric and Mechanical Draft
WATER COOLING TOWERS

HOW TO CONSERVE COPPER

IN CABLE SYSTEMS FOR WAR-JOB PLANTS

Use HIGHER VOLTAGE

WHEN you are planning expansion of an electric distribution system, or revamping plant wiring, there is an opportunity to save copper (compared with previous practice) by using as high voltage as you can. For example, cable at 480 volts requires only 26 per cent of the copper required for distribution at 208 volts.

Other effective conservation measures, when planning plant distribution for war production, are (1) use a high-temperature insulation because temperature limits of the insulation govern the permissible copper size; (2) use three-conductor instead of single-conductor cable wherever voltage regulation is the deciding factor, because the reactance drop in a three-conductor cable is less.

HOW MUCH COPPER CAN YOU SAVE?—Ask Us

In practically every case there can be a choice between two or more cables to do a job well. One, however, may permit a saving in copper—and will also conserve other vital materials.

Let us help you determine the cables that will do the job successfully and that will also conserve copper. General Electric cable engineers, both in your section of the country and at the factory, offer their services in figuring for you, or with you, just what the opportunities are.

When you save copper in the cable, you conserve copper in that part of the plant electrical distribution system where the copper requirements are the heaviest. For additional information, just ask the nearest G-E office, or write to General Electric, Schenectady, N. Y.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment.

NOT THIS

500,000 cir mils—conductor size for 208 volts

4.6 LB COPPER PER FOOT

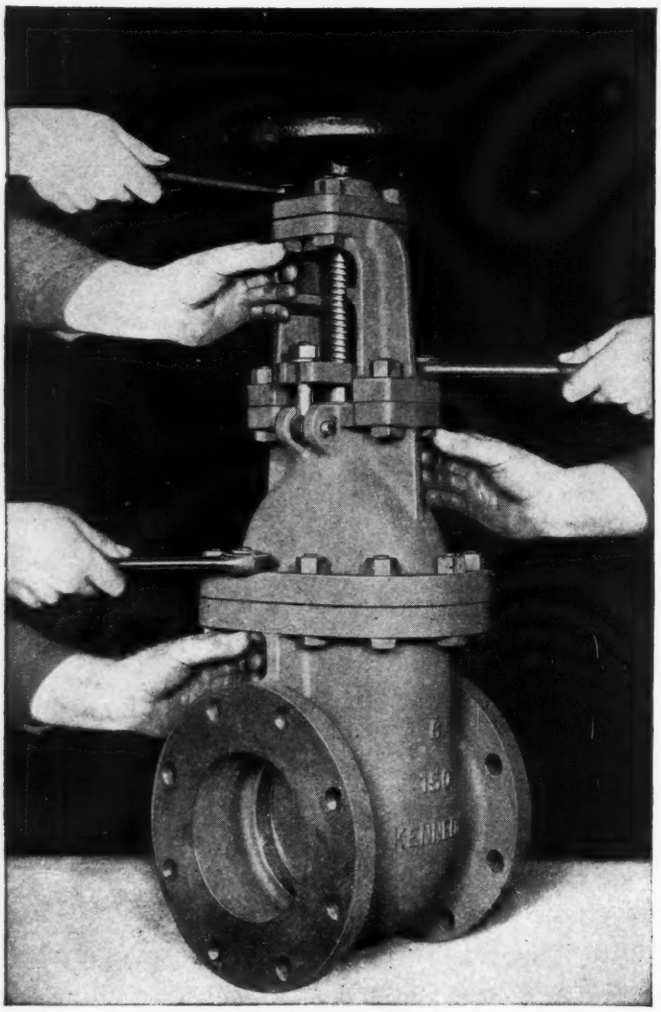
BUT THIS

2/0 Awg—conductor size for 480 volts

ONLY 1.2 LB PER FOOT

GENERAL ELECTRIC

501-15-1200



EVERY PART
easy to reach
easy to handle

CONVENIENCE is one of the outstanding characteristics of Kennedy Valves.

In this standard outside-screw-and-yoke Kennedy Iron-body Wedge Gate Valve, for example, the convenience features at the stuffing box alone include bolts that swing out of the way, washer-type nuts, slotted gland, and yoke shelves for the gland.

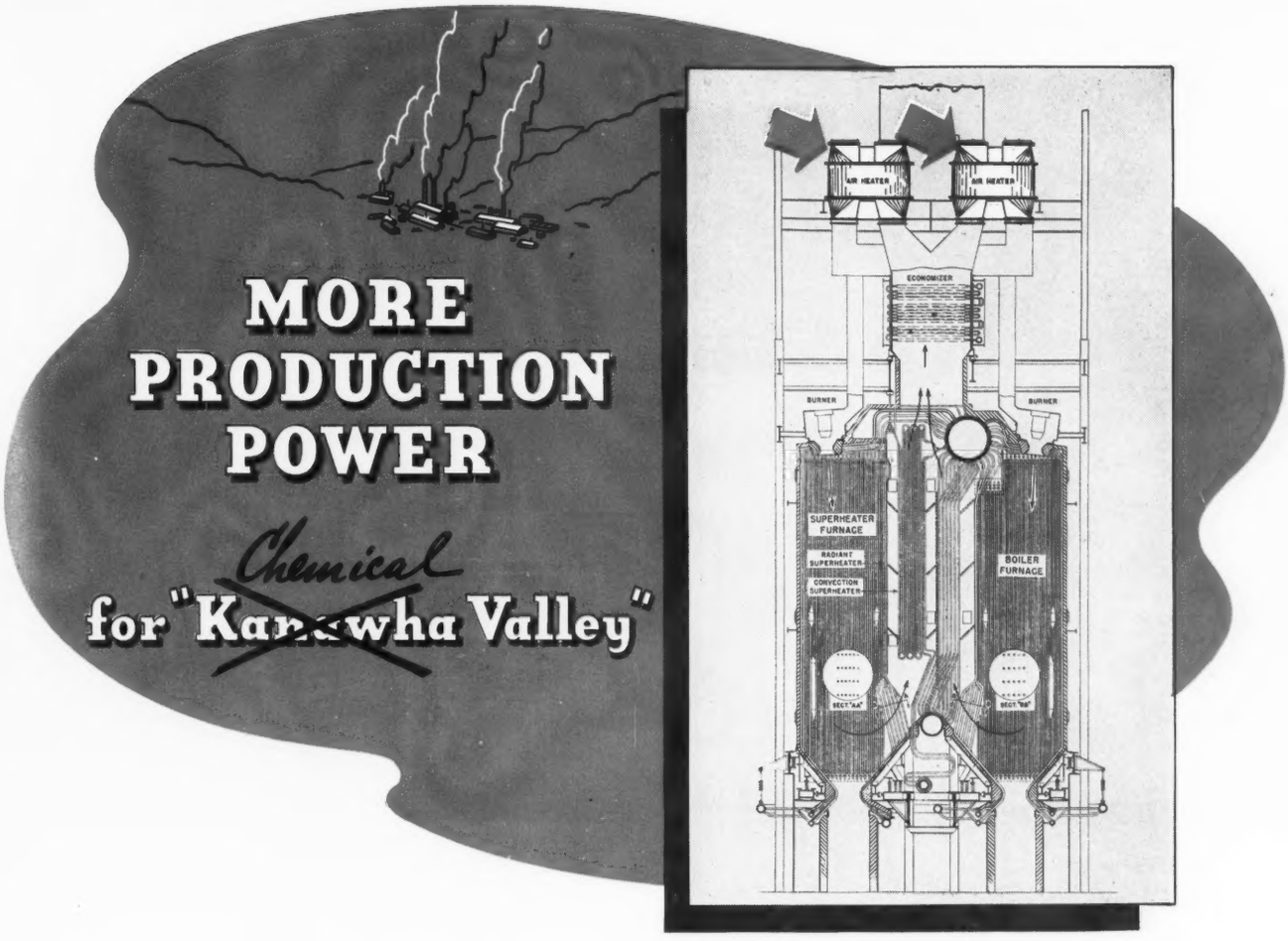
Again, all bolts throughout the valve have their nuts on top of flanges and are accessible to open-end wrenches. Handwheels have large-diameter, widely spaced spokes and oval rims for ample leverage and firm grip.

These convenience features indicate the care that has been given to every detail in the design of this and every other Kennedy Valve type, in addition to operating mechanisms that are thoroughly reliable, bodies with generous margins of extra strength, and construction throughout for long, dependable service with minimum maintenance expense.

You are safe when you use Kennedy Valves. Catalog describing the entire line of these extra value iron-body and bronze gate, globe, angle and check valves for all standard pressures and services will gladly be sent on request.

THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK

KENNEDY *valves... pipe fittings... fire hydrants*



Cabin Creek Station of Appalachian Electric Power Company Will Include 8 Ljungstrom Preheaters

Already, the Kanawha Valley area near Charleston, West Virginia, is one of the nation's great chemical production centers, and the end is not in sight. Four great new steam generating units, each with a capacity of 450,000 lb. per hr., are now being erected to meet the greatly increased power demand of this area. Each of these 1500 psi units will be equipped with two Ljungstrom Air Preheaters. Gases will enter the preheaters at 636° F., leave at 337° F., heating combustion air to 463° F.

* * * * *

The best evidence of the overall advantages of Ljungstrom Air Preheaters on high-efficiency steam plants is the consistency with which they are specified by those companies which have long experience with their use. The American Gas & Electric Company — of which Appalachian Electric Power Company is one unit — has over 50 of these preheaters in operation. Cabin Creek is only one of several units now in construction which call for their use.

Vitally important to the nation, as well as to the individual purchaser, are the *conservation* features of Ljungstrom Air Preheaters: These continuous regenerative counterflow units average *one-half* to *one-third* the weight of other types for the same degree of heat recovery, saving important quantities of steel both in the unit itself and in the supporting structure.

A new illustrated booklet, "Another Kind Of Air Power With A Wartime Job To Do," tells how the Ljungstrom is being used in wartime service. Case history information of savings resulting from use of the Ljungstrom makes it worthwhile reading. It's yours for the asking. Write for a copy today.

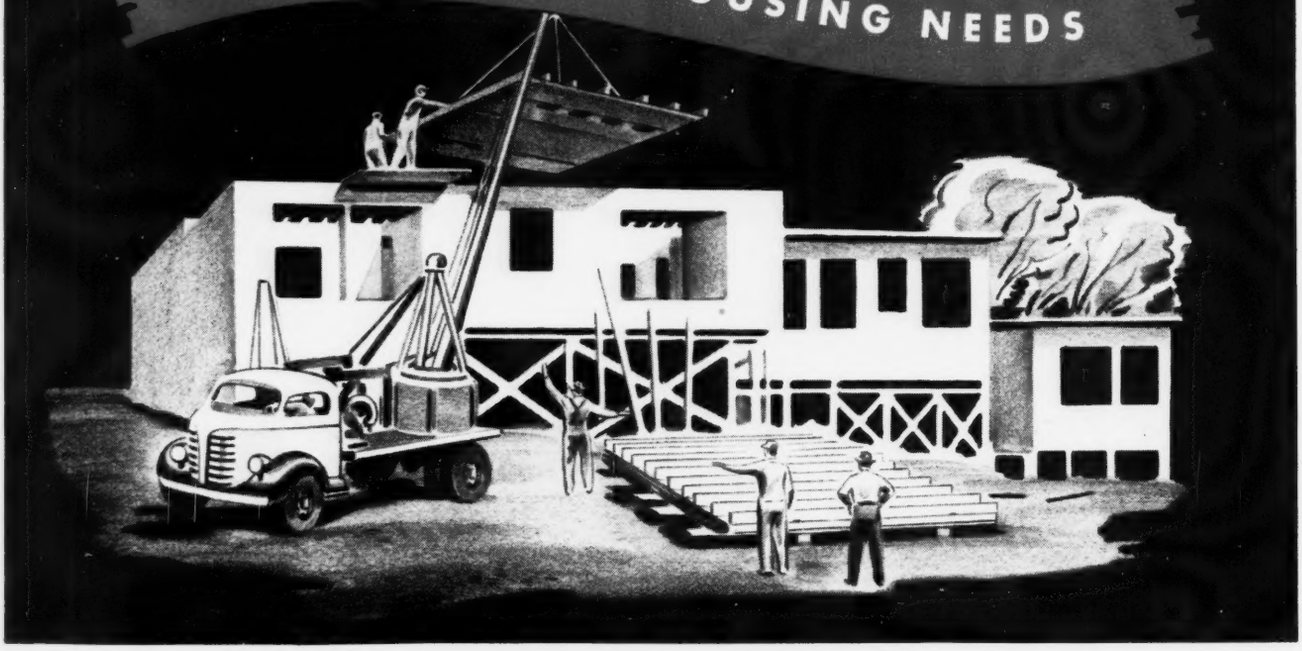
THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

PRE-FABRICATION
MEETS TODAY'S HOUSING NEEDS



In the herculean task of supplying adequate housing for great armies of war workers and their families, pre-fabrication has proved invaluable. It breaks bottlenecks . . . provides better homes more rapidly at less cost . . . makes best use of an inadequate supply of skilled building labor.

Pre-fabrication is also proving invaluable in meeting today's piping needs. It provides better piping at less cost, in less time, and makes most effective use of the supply of skilled labor.

Pre-fabricated piping is delivered in a series of subassemblies, each made to fit exactly into the total plan. Each is carefully shop tested, accurately aligned, preheated and stress relieved when necessary, and thoroughly cleaned. All difficult welding is done in well-equipped shops using special machinery to assure its quality. Field work is reduced to fewest and simplest operations.

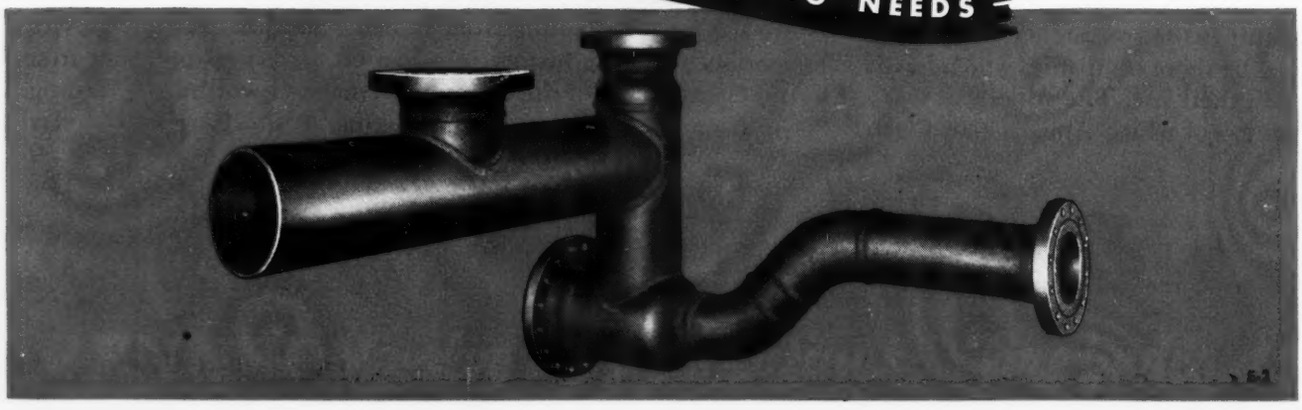
THE PIPE FABRICATION INSTITUTE

P.F.I. THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING **PITTSBURGH, PA.**

PRE-FABRICATION
MEETS TODAY'S PIPING NEEDS



CITY OF GREENVILLE, TEXAS

The latest addition to the municipal power plant is this six cylinder, 2400 horsepower gas burning Nordberg Diesel. In this same plant there are oil burning Nordberg Diesel units of 1000, 1450, and 2000 brake horsepower.

Another GAS BURNING DIESEL *goes into service*

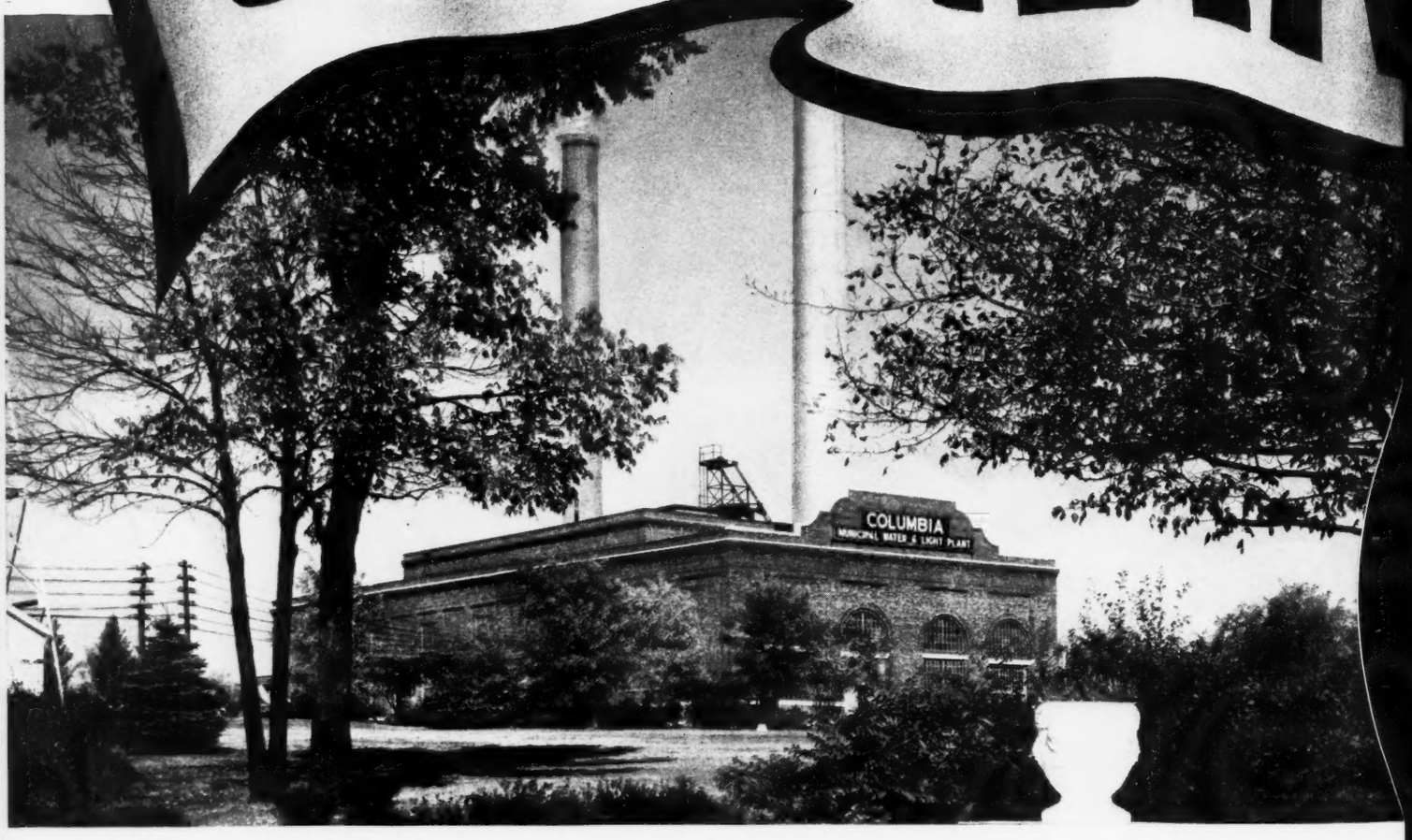
This 2400 horsepower convertible oil and gas burning Nordberg Diesel is typical of the many now in service and which have demonstrated the outstanding advantages of natural gas fuel when burned on the Diesel principle. Not only do these Nordberg Diesels conserve oil for wartime needs but the fuel cost when operating on gas as compared with oil has in some installations been reduced as much as 50 per cent. Another important feature is that should it be desired to change from one fuel to the other, this can be done quickly and without change of any major engine parts. The development of this convertible Diesel engine for operation on oil or gas is but one of the many contributions which Nordberg has made to the Diesel field.

We are proud to serve our country and to have been awarded the Navy "E" for EXCELLENCE in production.

NORDBERG MFG. CO • MILWAUKEE

NORDBERG
DIESEL ENGINES

pride of COLUMBIA



Columbia, Missouri, Water & Light Plant (above).

Columbia, Missouri, has plenty to be proud of —

There's the University of Missouri (Memorial Tower, at left) . . . Stephens College . . . and Christian College.

Then there's the beautiful countryside that first attracted the Kentuckians who settled Columbia, back in 1815 . . . Good land for dairying, truck farming.

Coal mines and stone quarries are nearby. And the great Missouri River is only 10 miles south.

Columbia has railroads, industries. The city is proud (has a right to be) of the way her citizens and resident students have swung into action to help speed Victory.

Yes, this up-and-coming Missouri city has a lot to be proud of. And you'll find that Columbia's citizens take especial pride in the Water and Light facilities, so important to good health, comfort, civic and industrial progress.

We of American Blower are proud, too, that we have had a part in equipping the modern electric generating station of the Columbia Water & Light Plant. American Blower Forced and Induced Draft Fans, Fluid Drive (Hydraulic Coupling) and Dust Precipitator equipment are dependably functioning here.

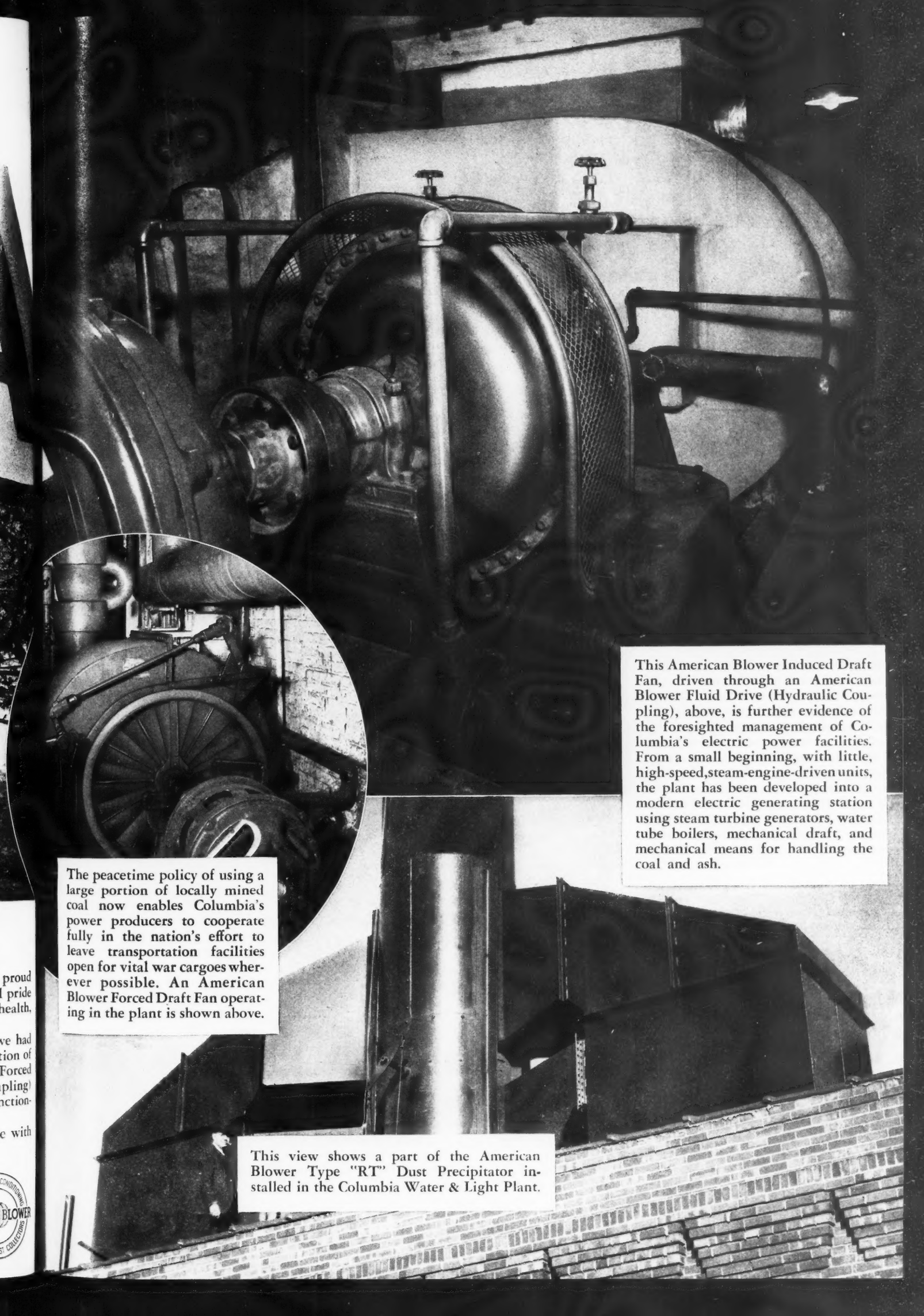
We would also welcome an opportunity to cooperate with you.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN • In Canada: CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN Radiator and Standard Sanitary Corporation

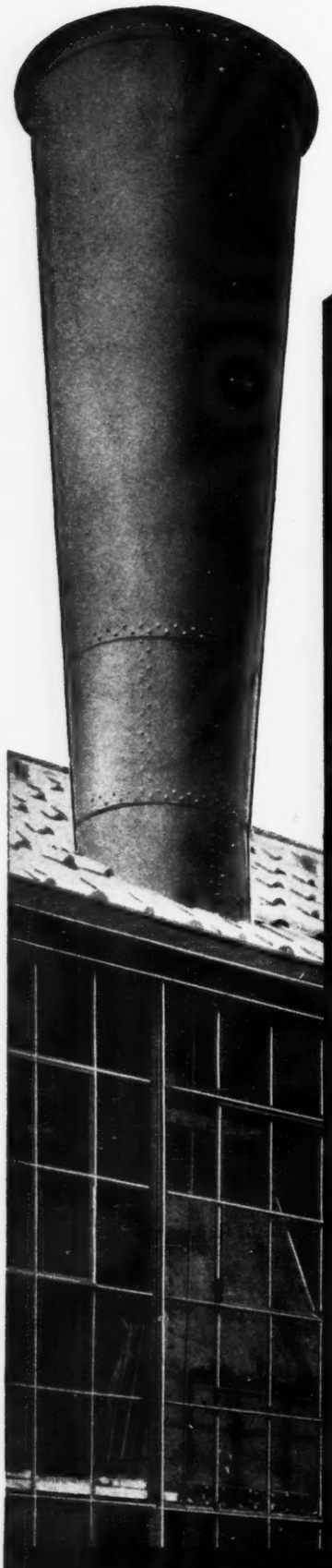
MECH DRAFT · AIR-CONDITIONING · AMERICAN BLOWER · FLUID DRIVES · DUST COLLECTORS



This American Blower Induced Draft Fan, driven through an American Blower Fluid Drive (Hydraulic Coupling), above, is further evidence of the foresighted management of Columbia's electric power facilities. From a small beginning, with little, high-speed, steam-engine-driven units, the plant has been developed into a modern electric generating station using steam turbine generators, water tube boilers, mechanical draft, and mechanical means for handling the coal and ash.

The peacetime policy of using a large portion of locally mined coal now enables Columbia's power producers to cooperate fully in the nation's effort to leave transportation facilities open for vital war cargoes wherever possible. An American Blower Forced Draft Fan operating in the plant is shown above.

This view shows a part of the American Blower Type "RT" Dust Precipitator installed in the Columbia Water & Light Plant.



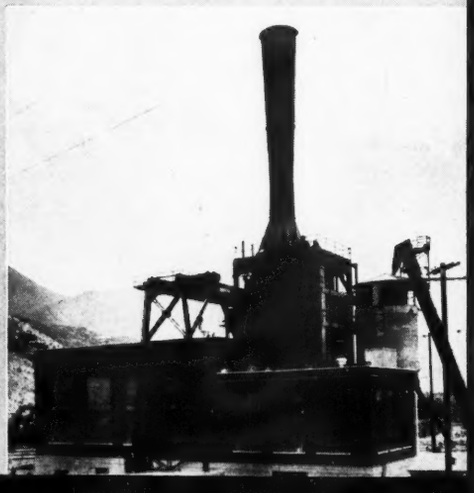
A Product Must Make Good To Warrant Repeat Orders

Following is a partial list of concerns who originally installed one Thermix Fan Stack. That stack made good; so good that since then they have sent us from one to eleven additional orders.

Thermix Stacks always make good—we see to that.

American Cyanamid Co.	2 orders
American Potash & Chem. Co.	2 orders
American Rolling Mill Co.	5 orders
Bendix Aviation Corp.	3 orders
Champion Fibre Company	2 orders
Consolidated Paper Co.	4 orders
Container Corporation	2 orders
Duval Texas Sulphur Co.	3 orders
E. I. duPont de Nemours & Co.	2 orders
Ethyl-Dow Chemical Co.	2 orders
Federal Light & Traction Co.	3 orders
Fisher Lumber Company	2 orders
Ford Motor Company	2 orders
Globe Oil & Refining Co.	3 orders
Hazel-Atlas Glass Co.	2 orders
Houston Lighting & Power Co.	2 orders
International Harvester Co.	11 orders
International Print. Ink Corp.	2 orders
Iowa Southern Utilities	2 orders
Jones & Laughlin Steel Corp.	3 orders
Lancaster Cotton Mills	2 orders
Ohio River Power Co.	2 orders
Old Quaker Distillery	4 orders
Procter & Gamble Mfg. Co.	8 orders
Public Service Co. of Colo.	2 orders
St. Joseph Ry. Lt. & Pr. Co.	3 orders
Schenley Distillers	5 orders
Swift & Company	2 orders
Southern Mineral Products Corp.	2 orders
Utilities Power & Light Co.	2 orders

Isn't the experience of the above concerns worthy of your serious consideration? Write for catalog No. 109 and find out for yourself about Thermix Stacks which have won the unqualified endorsement of these far-seeing business men.



PRAT-DANIEL CORPORATION

Manufacturers of Dust Collectors and Induced Draft Thermix Stacks

82 SO. WATER ST.
PORT CHESTER, N. Y.

Representatives in Principal Cities

THERMIX FAN STACK

QUICKLY...WITHOUT WAITING FOR NEW BOILER DELIVERIES

• If you need more steam now—and can't wait for new boiler deliveries—it will pay you to investigate restokering your existing boilers with Stowe Stokers.

Due to their exclusive grate construction, Stowe Stokers permit the air necessary for efficient combustion to be supplied evenly and uniformly to all parts of the fuel bed, resulting, naturally, in exceedingly rapid burning,—and a much greater steam output from a given boiler than can possibly be secured with older less efficient stokering equipment.

Records on job after job in the utility, metal working, rubber and many other industries, show that boiler outputs have been increased from 33% to 100%, simply by restokering existing boilers with Stowe Stokers. These savings are not theoretical, but the actual proven results, secured by users, many of whose names you would instantly recognize.

We will be glad to have one of our engineers analyze your present facilities thoroughly and impartially, and tell you how much more steam you can reasonably expect to get by restokering with Stowe Stokers. Do not hesitate to write us fully about your situation,—or to send for our descriptive catalog. Write today!

THE JOHNSTON & JENNINGS CO.

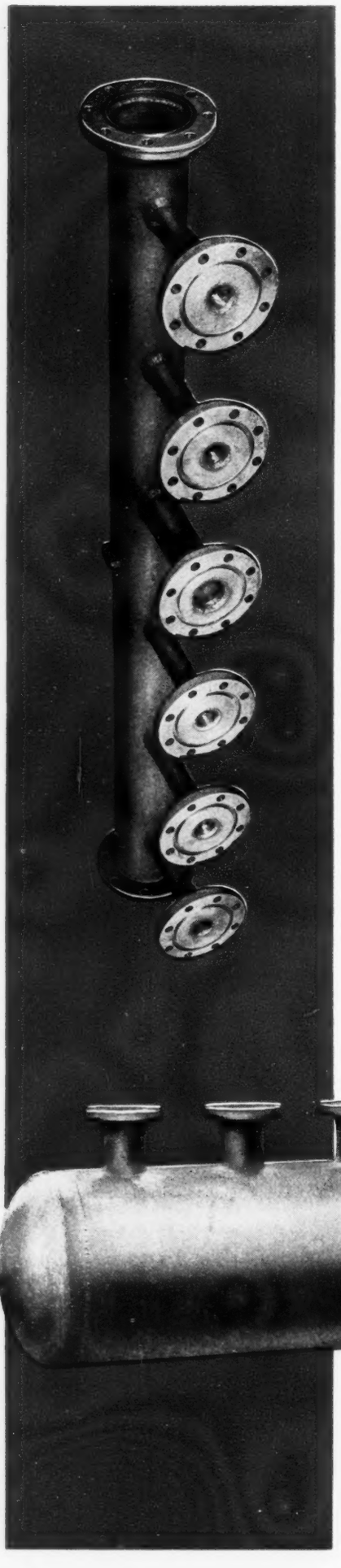
DETROIT — 878 Addison Road, CLEVELAND, OHIO — CHICAGO

Engineering and Sales Representatives in

New York • Pittsburgh • Kansas City • St. Louis

STOWE STOKERS

GIVE YOU MORE STEAM FROM LESS COAL



IMPORTANT

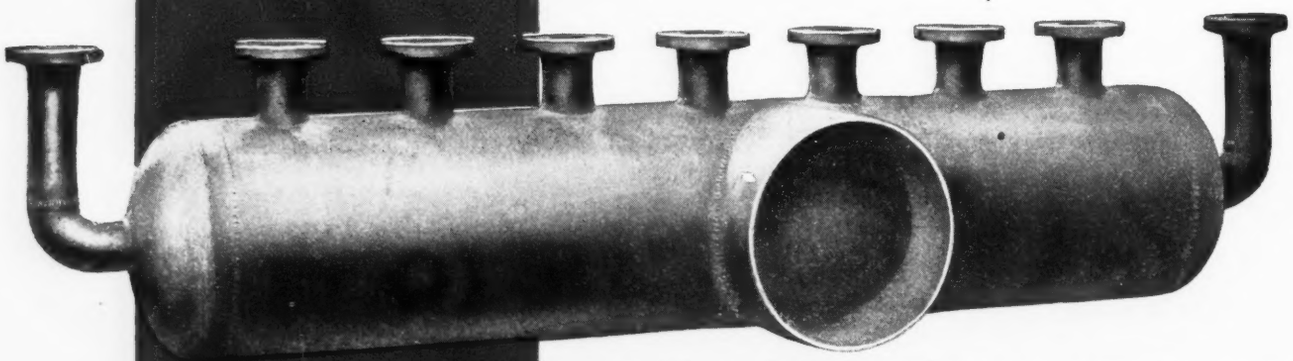
6 IN. OR 30 IN.

THE QUALITY IS THE SAME

Kellogg prefabricated piping assemblies, simple as those shown here, or as intricate as required for the most individual conditions — ranging in pressure from 200 to 2200 pounds—are installed in various power plants in this country.

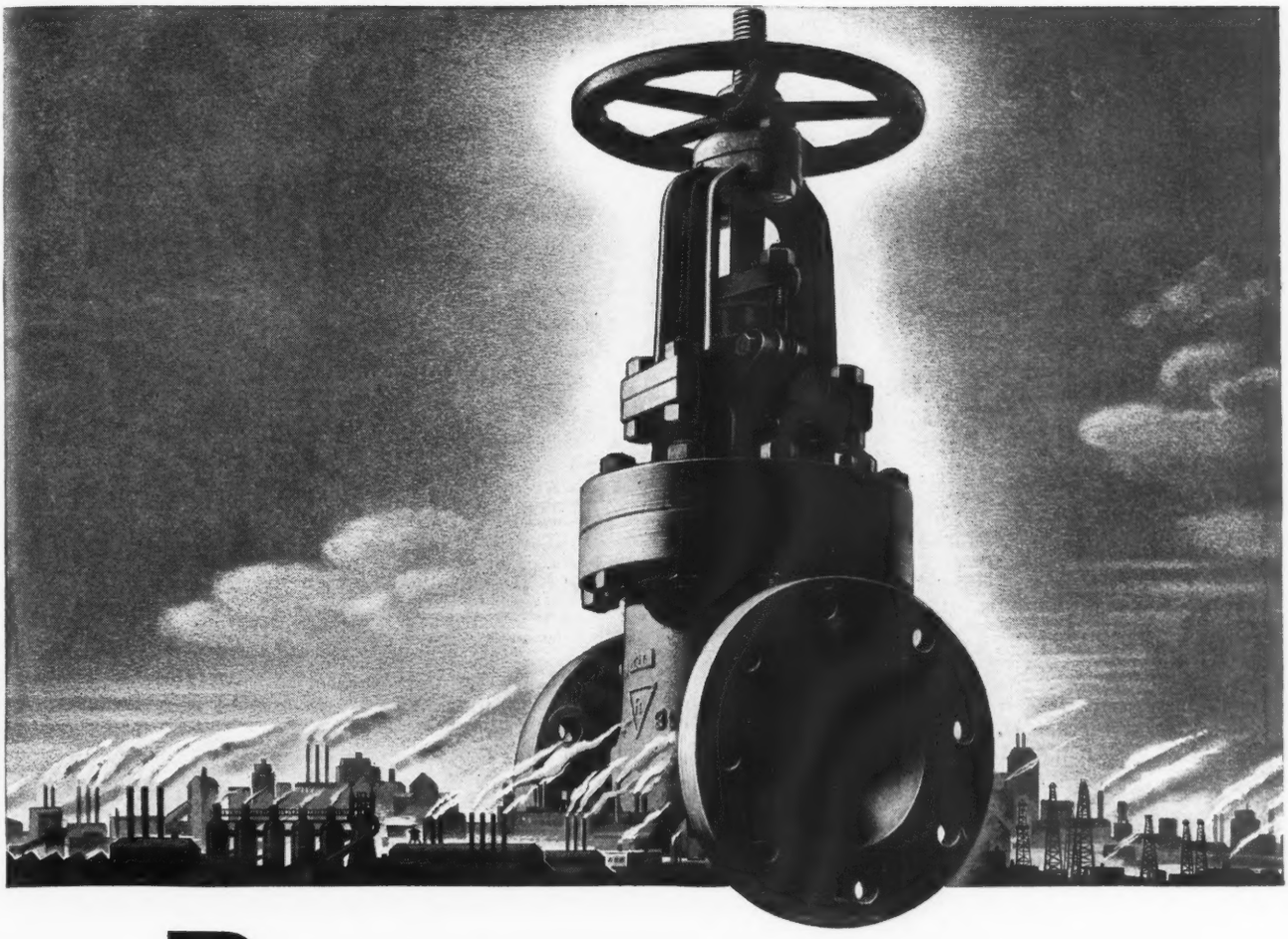
Accurately prefabricated and thoroughly tested in the Kellogg shops these assemblies are shipped ready to connect, saving time and money on the job.

In fact, consulting engineers, operators of central stations, industrial and marine power plants, find that pinning the responsibility for piping on The M. W. Kellogg Company is the most satisfactory solution to their problems.



KELLOGG **THE M. W. KELLOGG COMPANY**
JERSEY CITY, N.J. · 225 BROADWAY, N.Y.
Representatives:
LOS ANGELES: 609 SOUTH GRAND · TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems · "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · JUIK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.



Protect the valves you've got

DON'T use a wrench on the hex farther from the joint. A twisted body may be the result.

DON'T install a valve while it is in the open position. The chance of twisting it is lessened when it is in the closed position.

DON'T install a valve so that it will carry the weight, sag or expansion of the line. Proper supports and expansion bends or joints should be provided.

DON'T cut overlength threads on a pipe to be screwed into a valve. The pipe might shoulder against the valve seat and injure it beyond repair.

DON'T apply grease or paint to the end threads of a valve. Put it on the pipe threads and it won't get on the valve seat to collect grit or scale.

DON'T fail to blow out a new or altered line. Valve seats ruined by chips or dirt may be the penalty.

DON'T use a long lever and a strong pull on a screwed joint. A short lever and a few taps with a hammer are more effective and won't twist the valve.

DON'T try to re-assemble a valve without full knowledge of its construction. Consult the catalogue and eliminate chances of ruining the valve or of costly shut-downs.

DON'T try to re-assemble a valve with disc and stem in the closed position. A scarred seat and a bent spindle may be the result.

DON'T force a leaking valve. Usually the leak is due to foreign matter on the seat which may be cleared by opening the valve part way to flush.

DON'T use gate valve or cocks for throttling. Globes and angles are the only kinds of valves for this purpose.

DON'T install automatic stop and check valves in any but an upright position. For satisfactory operation the disc and piston must have a gravity drop.

READING-PRATT & CADY

MANUFACTURERS OF

CAST STEEL VALVES · BRASS AND IRON VALVES · D'ESTE ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONNECTICUT

These 2 Words MAKE MOTOR-DRIVE *MORE THAN* POWER!

- *Motor-drive provides within itself a means of*

Speed Control	Reversing
Braking	Remote Control
Tandem Operation	Controlled Acceleration
Tension Control	Safety

Slow Speeds for inching, threading, inspection

Applying them to boost production and improve quality
APPLICATION ENGINEERING. That's our busines

In process just behind these windows are armature coils, field coils, stator coils, all in great variety—evidence that the Reliance Motors of which they will be a part are designed to perform many functions besides turning shafts and gears. Motors will fit the job. They are going to users who started their machine design and production plans with the question, *"What can we get the motor to do besides supply power?"* Help in answering this question can be given by Reliance men trained to think of motor-drive in terms of production. There's no obligation involved in asking us to sit in with you and talk it over.

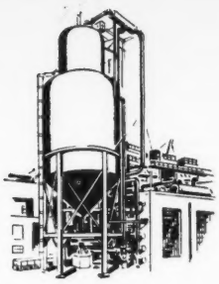
RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 IVANHOE ROAD • • • CLEVELAND, OHIO

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE, S. C.
HOUSTON, TEXAS • LOS ANGELES • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH
PORTLAND, ORE. • ST. LOUIS • SAN FRANCISCO • SYRACUSE, N. Y. • AND OTHER PRINCIPAL CITIES

RELIANCE A-C D-C MOTORS

HELPING TO KEEP THOSE SMOKESTACKS BUSY—

PERMUTIT SILICA REMOVAL PROCESS



4 features of Permutit's Mag-de-Sil* process:

1 Removes silica and does not increase total dissolved solids.

2 Economical . . . moderate amounts of low-cost reagents used.

3 Adaptable to hot or cold lime soda water softeners.

4 Applicable to existing equipment or special units may be installed.

PREVENT SHUTDOWNS . . . by using boiler feed treatment to fit your plant

Deposits of silica scale in boiler tubes, superheaters and turbines is only one of the many ways in which improper feed water may cut capacity at power plants. Permutit prevents these troubles, provides a water conditioning process to fit every raw water condition, every individual plant requirement. Now more than ever you need this protection at your plant. Write for booklet: The Permutit Co., Dept. A, 330 West 42nd St., New York, N. Y.

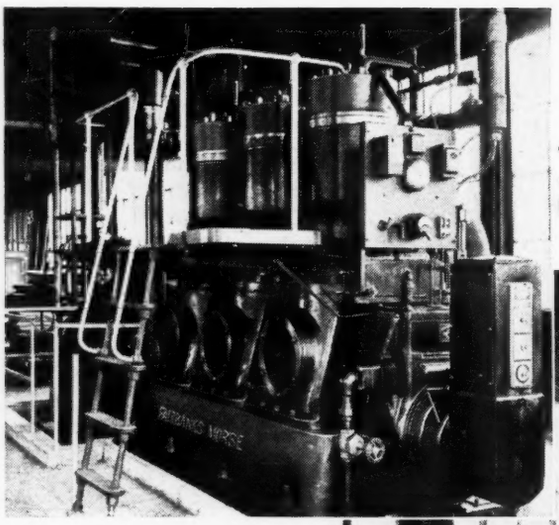
In Canada: Permutit Company of Canada, Ltd. . . . Montreal . . . Toronto . . . Winnipeg . . . Calgary.

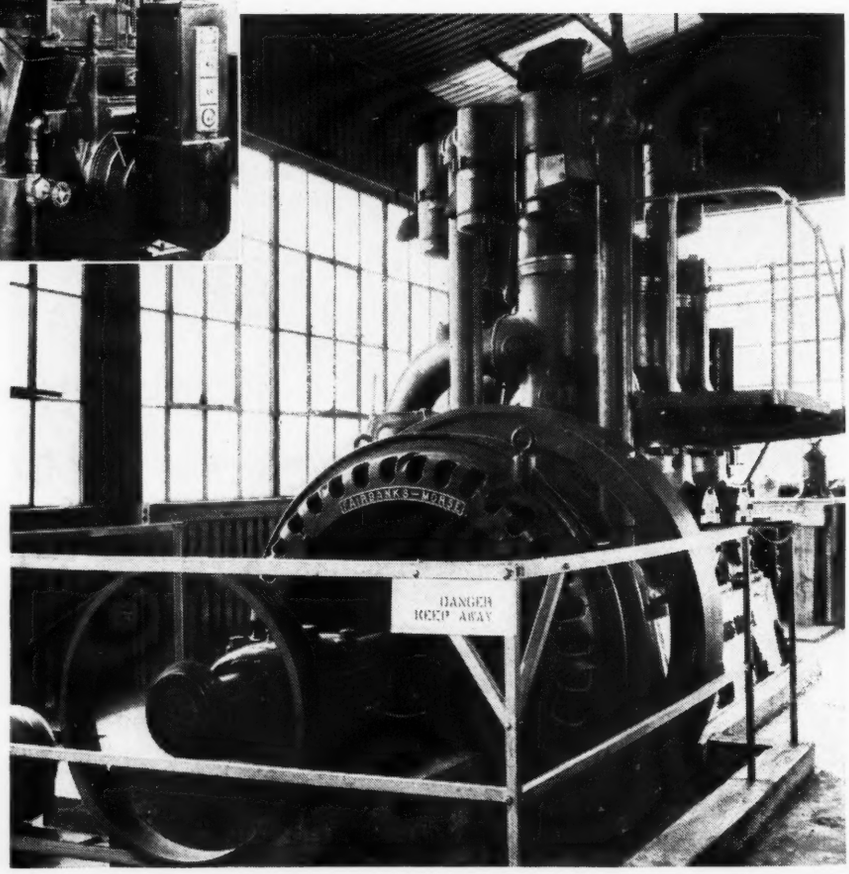
*Trademark Reg. U.S. Pat. Off.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

ECONOMICAL POWER ...AND





● The Lyon-Conklin Company of Baltimore operates one of the largest sheet metal building supply plants in the country. For seventeen years, Fairbanks-Morse Diesels have distinguished themselves for operating economy, dependability, and low maintenance cost in this plant. The three F-M Diesels in this plant require the part-time attention of only one man.

FAIRBANKS-MORSE

DIESELS
MOTORS
SCALES
PUMPS

FOR NOW

TOMORROW, TOO!

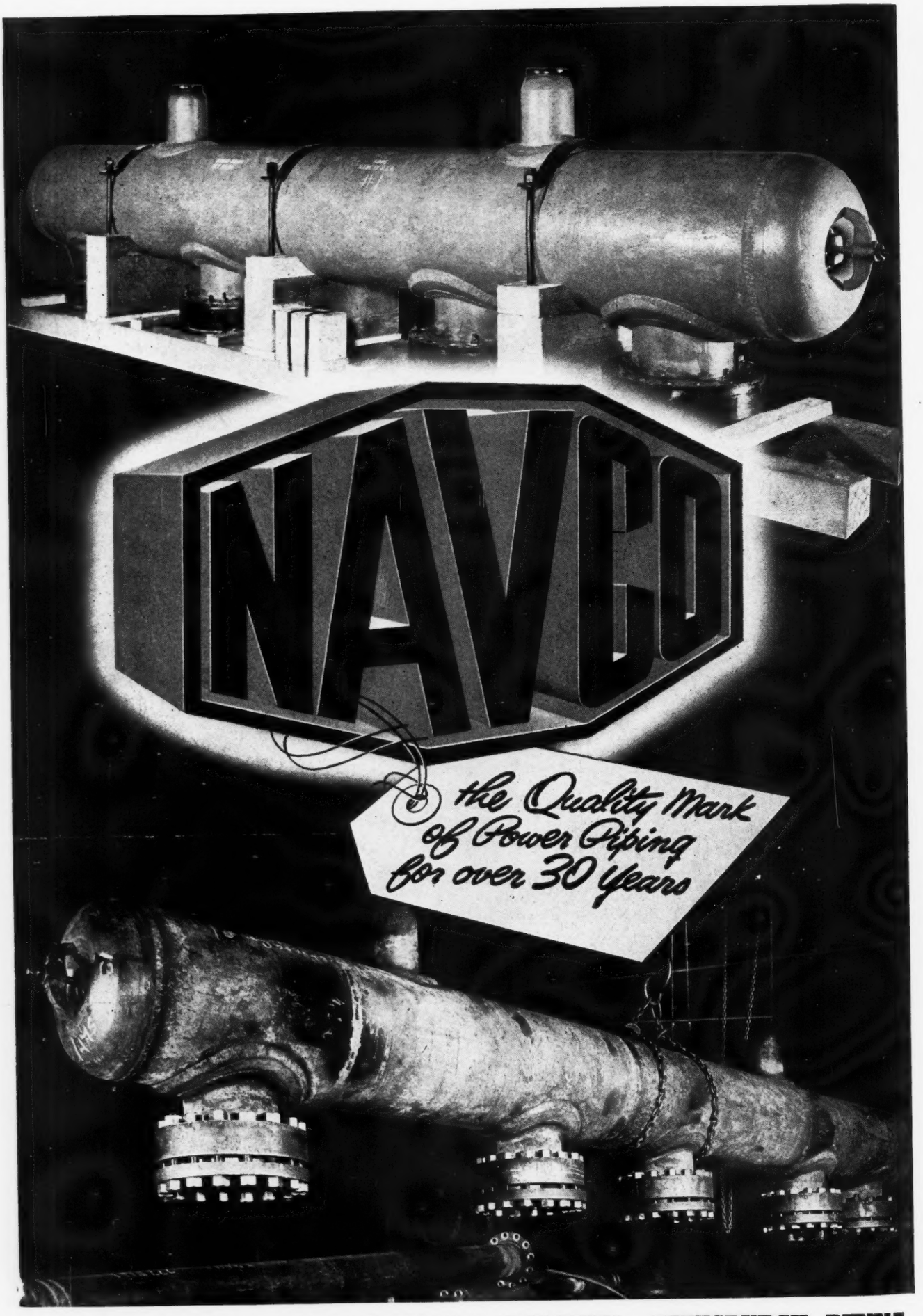
TIME is the essence. America cannot wait. Mills, mines, factories, and plants are accomplishing the "impossible"— and in every type of operation, Fairbanks-Morse Diesels are supplying the power essential to production. And they are doing it with the economy and dependability for which F-M Diesels are traditionally famous.

They are avoiding peak penalties . . . giving stand-by service at low cost . . . generating hard-to-buy, off-standard types of current for special equipment . . . and paying dividends in power costs saved.

Inquiry entails no obligation. Use your priority to get the kind of Diesels which give dependable, economical power for now — and for tomorrow, too. Fairbanks, Morse & Co., 600 S. Michigan Avenue, Chicago, Ill.

FAIRBANKS-MORSE

DIESELS
MOTORS
SCALES
PUMPS

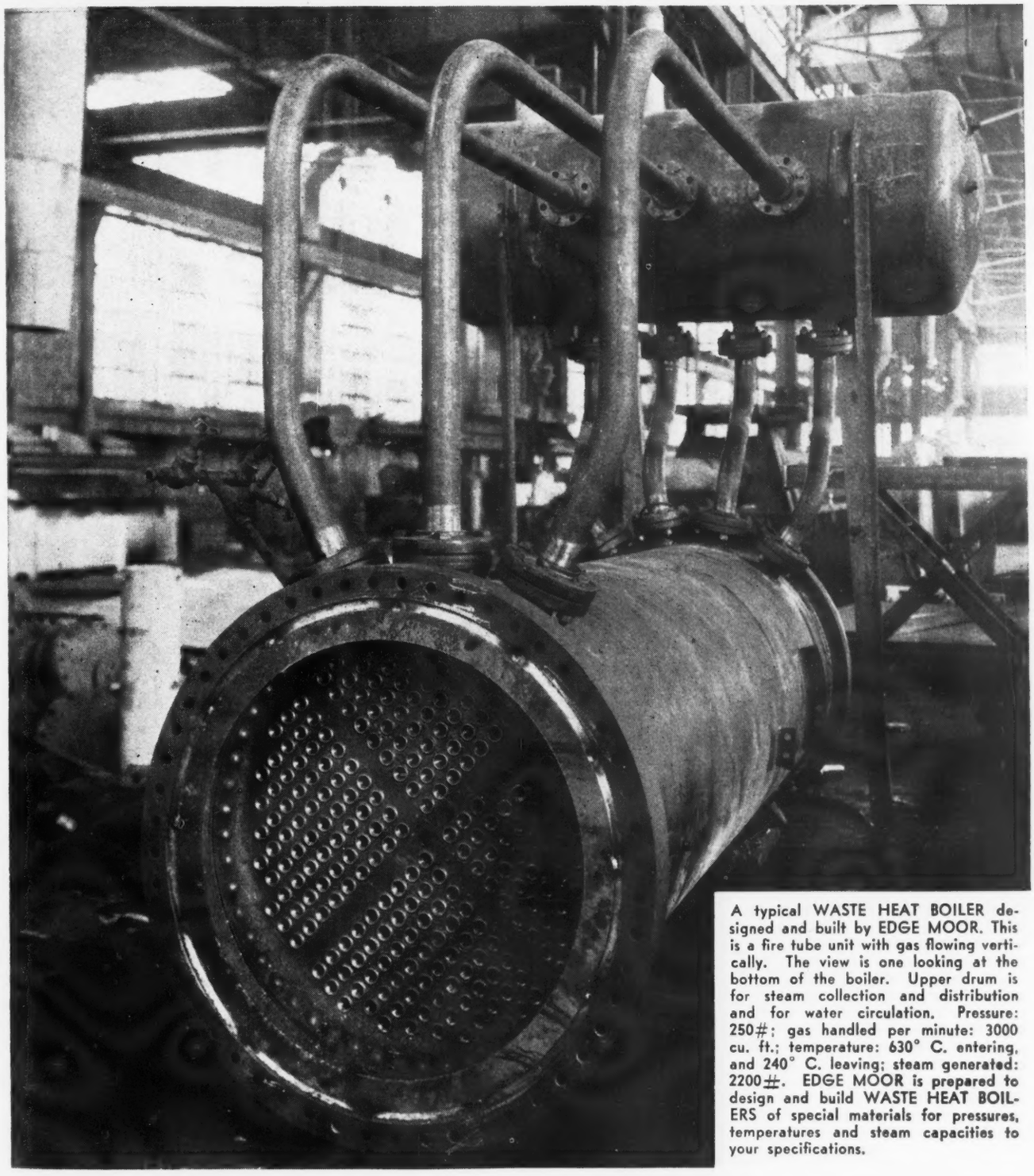


NATIONAL VALVE & MANUFACTURING COMPANY — PITTSBURGH, PENNA.

WASTE HEAT BOILERS

designed to meet your specific requirements

by **EDGE MOOR**



A typical WASTE HEAT BOILER designed and built by EDGE MOOR. This is a fire tube unit with gas flowing vertically. The view is one looking at the bottom of the boiler. Upper drum is for steam collection and distribution and for water circulation. Pressure: 250#; gas handled per minute: 3000 cu. ft.; temperature: 630° C. entering, and 240° C. leaving; steam generated: 2200#. EDGE MOOR is prepared to design and build WASTE HEAT BOILERS of special materials for pressures, temperatures and steam capacities to your specifications.

EDGE MOOR IRON WORKS, INC. 30 ROCKEFELLER PLAZA NEW YORK, N. Y.

KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

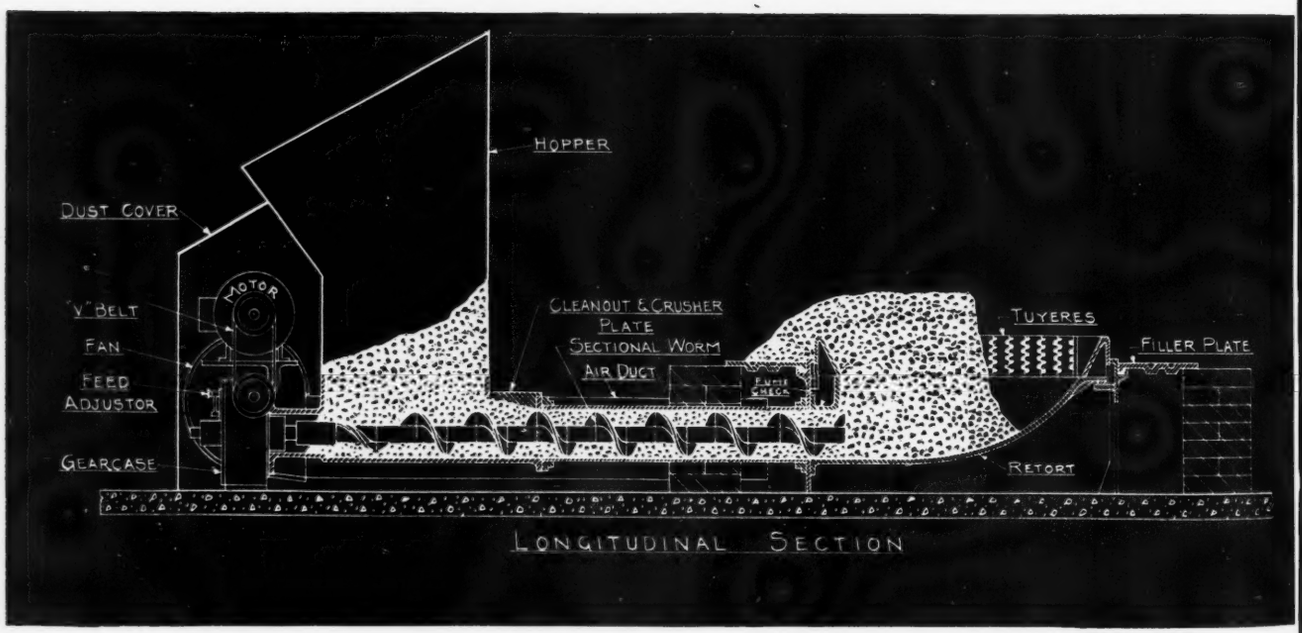
IN CANADA:— UNITED STEEL CORPORATION, LTD., TORONTO, MONTREAL

also...

CANTON STOKER

EXTRA HEAVY WORM FEED CANTON STOKERS

. . . for the sm aller plants



Cutaway view showing assembly of DeLuxe Stoker and method of feeding coal. This gives you a complete picture of the stoker's action, along with good views of the various components that go to make up the entire stoker.

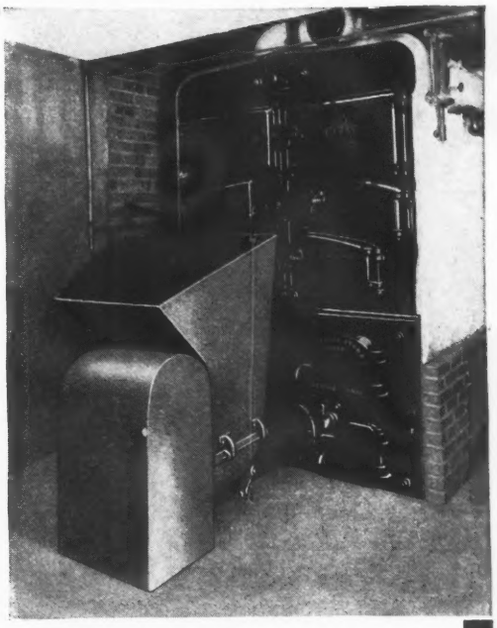
CANTON STOKER CORP.

Mfgrs. of Vulcan Ramfeed Stokers . . . . up to 850 H.P.
Lo-Set Ramfeed Stokers . . . . up to 450 H.P.

Mfgrs. of Deluxe Wormfeed Stokers . . . . up to 175 H.P.
Standard Wormfeed Stokers....up to 125 H.P.

. . . convert now from

OIL to COAL!



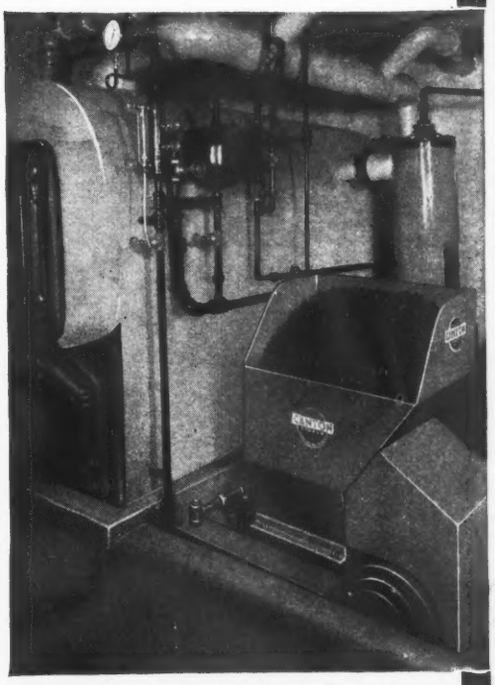
DeLuxe Side Dump Stoker adapted to a Cast Iron Sectional Boiler. The Full Front adds trimness to the job, as well as providing accessibility and cleaner operations.

Canton Standard and DeLuxe Side Dump WORM FEED Stokers are, generally speaking, smaller editions of the recognized, approved CANTON VULCAN and LO-SET RAMFEED Stokers, widely used on High Pressure Power and Process Boilers. Like their larger counterparts, they're carefully engineered and built with precision, so as to get the best performance from each type of boiler.

Simple and sturdy in design, these smaller units operate at low cost . . . . are seldom "off the line" for servicing . . . . reduce fuel costs by producing more heat from the fuel . . . . burn cheaper grades and sizes of coal . . . . eliminate soot in boiler flues.

With these Canton Stokers in service on your boilers, you can go a long way toward achieving labor conservation, more constant steam pressures, stepped-up production, reduced spoilage and compliance with local smoke ordinances.

Surely, an investment in these Stokers will quickly liquidate itself in savings and service. Want complete details? . . . . fill in and mail the attached coupon, or, write, wire or phone our nearest office or our factory and ask for a Free Consultation on Combustion Problems . . . our staff of Field Engineers is at your Service.



Clinker Plate installation made from side of Boiler. Where space in front of Boilers is limited, a side installation often provides a practical solution.

WRITE FOR THIS CATALOG

Here you'll find all the pertinent data that will enable you to intelligently plan for and use CANTON STANDARD and DELUXE Stokers.

741 ANDREW PLACE, S.W.

CANTON • OHIO

CANTON STOKER CORPORATION
741 Andrew Place, S.W., Canton, Ohio

Gentlemen:
Please send me at once your new catalog covering the Standard and DeLuxe Extra Heavy Worm Feed Stokers.

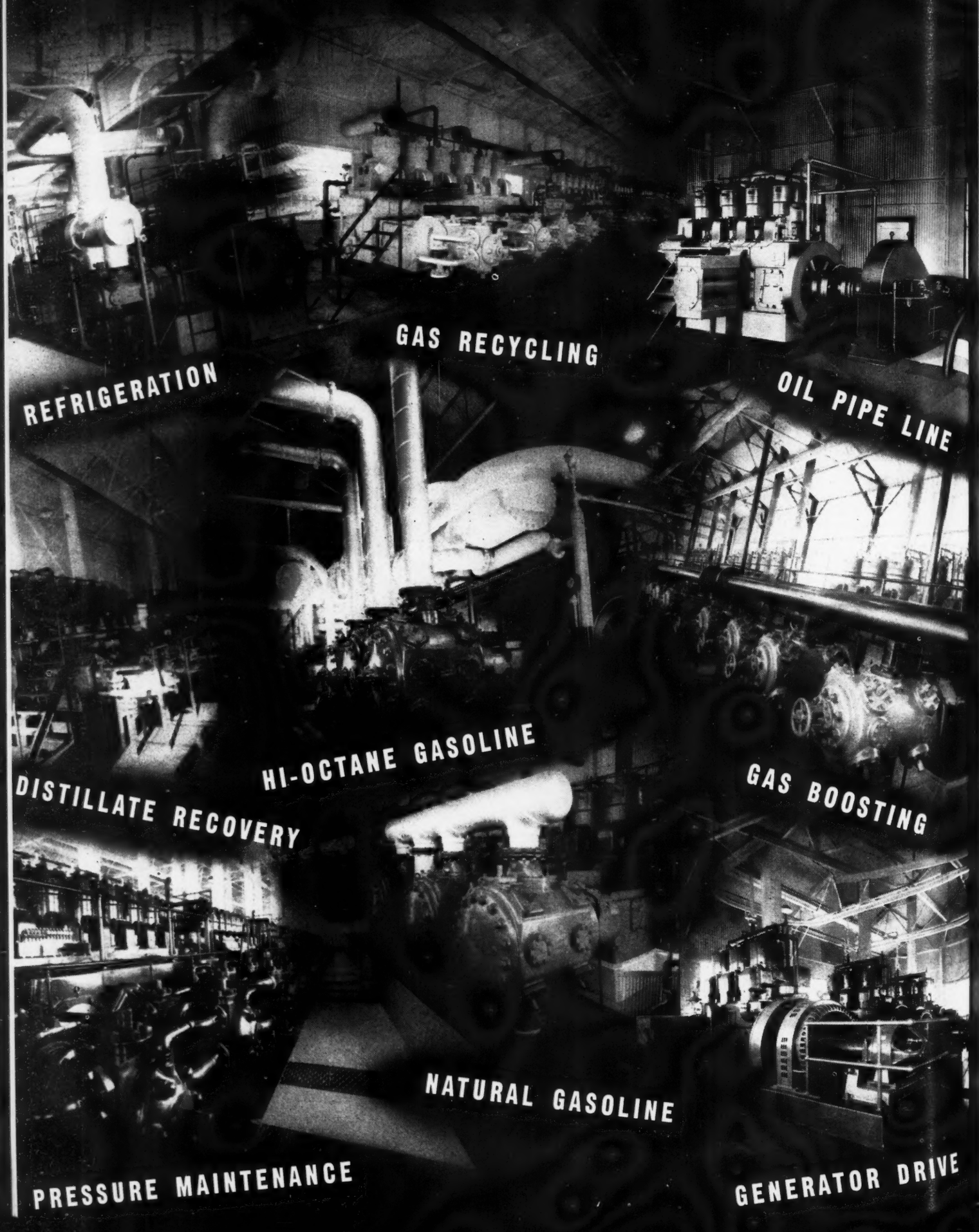
Name .....

Company .....

Address .....

City ..... State .....

CLARK "ANGLES" SPE



EED INSTALLATION!

Shipped Assembled... Minimum Foundations and Floor Space

TODAY, when speed is the watchword throughout industry, CLARK Gas, Diesel and Steam Driven "Angle" Compressors offer the great advantage of maximum speed of installation. Their compact design permits them to be shipped almost completely assembled, — has reduced more than 50% the size of foundations required, as compared with the older horizontal compressors, — and has greatly reduced area of floor space and size of buildings required. See photos at right.

Economy of money as well as time is also highly important today. It is to be noted that the factors mentioned which save time also involve large money savings.

Here are a few of the purposes for which CLARK "Angles" are today in wide demand in the world's industries: Natural Gasoline Recovery, High Octane Gasoline Manufacture, Gas Recycling, Distillate Recovery, Gas Boosting, Oil Refining, Pressure Maintenance, Oil and Gasoline Pipe Line Pumping, Gas Liquefaction, Gas Distribution, Manufacture of Synthetic Ammonia, Synthetic Alcohol, Toluene, Oxygen, Helium, Magnesium, Carbon Dioxide, and other gases and chemicals, Synthetic Rubber Manufacture, Water Flooding, Generator Drive, Refrigeration, Air Compression for glass plants, rock quarries, mines, foundries, machine shops, tank, plane, aluminum and steel plants.

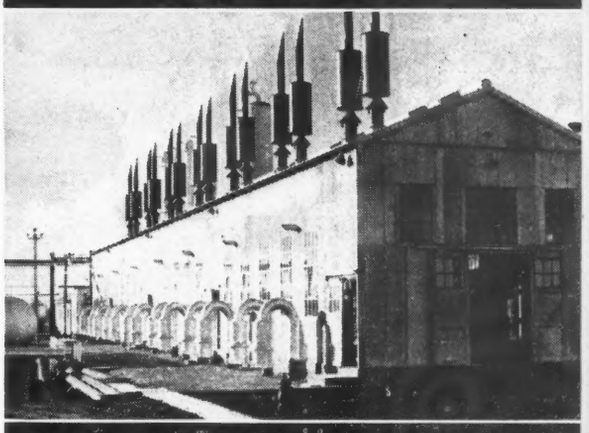
Clark engineers are at your service for consultation and recommendations. Call our nearest office.

CLARK BROS. CO., INC., Olean, N.Y.
Export offices: 30 Rockefeller Plaza, New York. Domestic Sales Offices and Warehouses: Tulsa, Okla.; Houston, Tex.; Chicago, Ill. (122 S. Michigan Ave.); Boston, Mass. (131 Clarendon St.); Huntington Park, Calif. (5715 Bicket St.); Foreign Offices: 72 Turnmill St., E. C. 1, London; Avda Roque Saenz Pena 832, Buenos Aires.

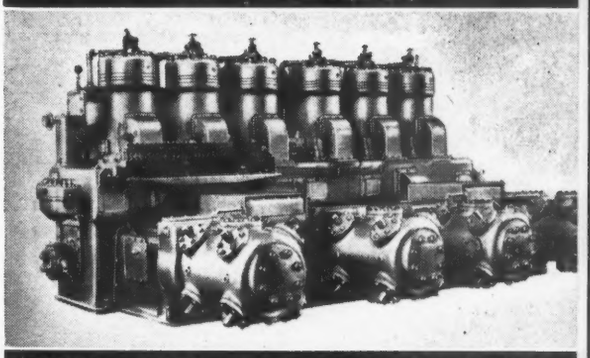
Affiliated Companies: Dresser Manufacturing Co., Bradford, Pa.; Pacific Pump Works, Huntington Park, Calif.; Bryant Heater Company, Cleveland, Ohio.

CLARK

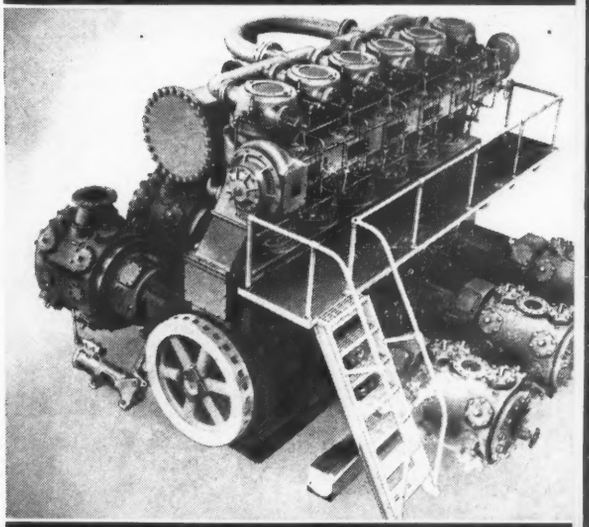
Shipping a CLARK 6-Cylinder Gas-Driven "Angle" fully assembled except for attaching the 4 Compressor Cylinders



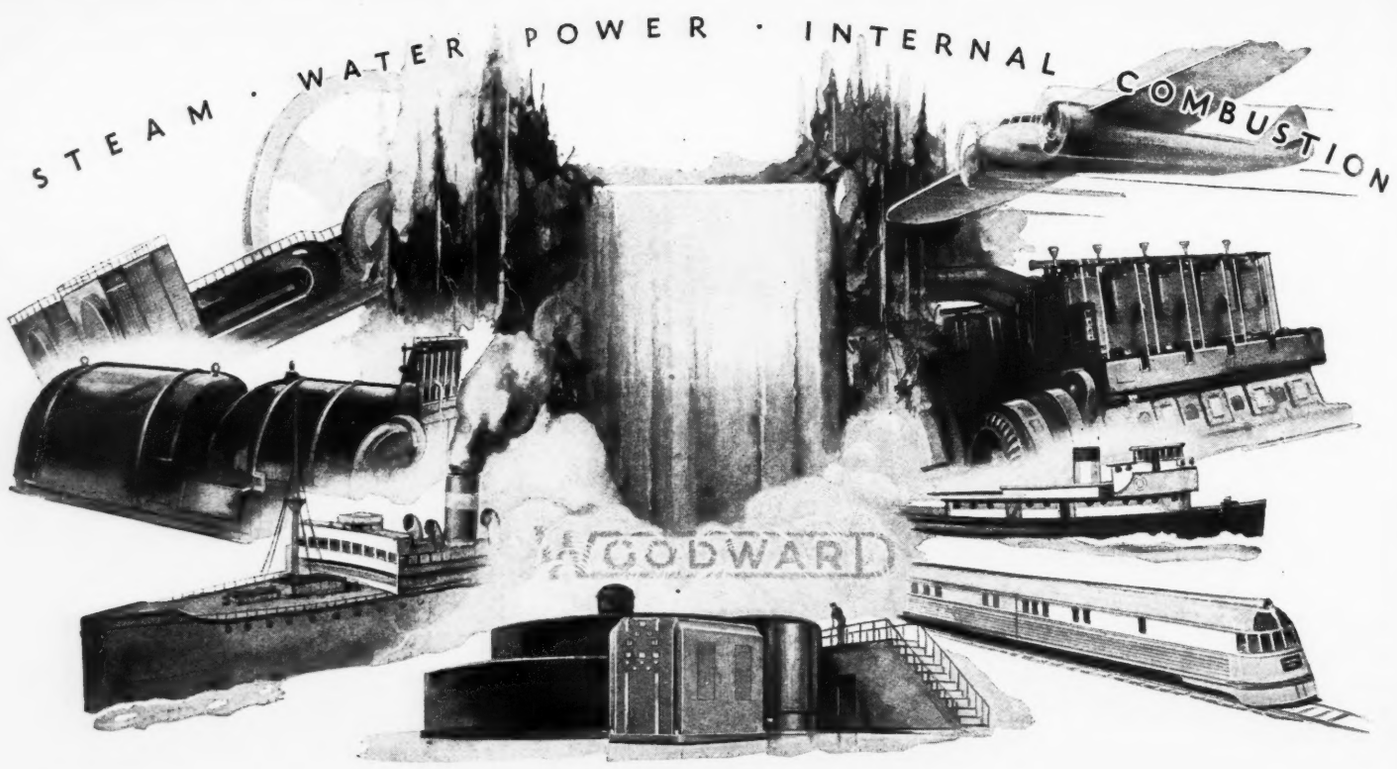
This building, only 24 feet wide, houses 7 600 H. P. CLARK "Angle" Compressors, totaling 4,200 H. P.



CLARK 6-Cyl. "Angle" Compressor, gas or Diesel driven. Sizes from 2 to 8 cylinders: Gas-Driven 200 to 1000 H. P.; Diesel Driven, 175 to 700 H. P.



CLARK Model 4 SCRA-14 Steam Engine Driven "Angle" Compressor. Built in 2 to 8-Cyl. Sizes, ranging from 500 to 4,000 H. P.



WOODWARD'S long and varied experience was put to effective use by our armed forces years before this war began. Our fighting units entered the field equipped with precision governing equipment because —

1. Designs were perfected and proved long before the present conflict.

2. New designs were available to meet the present-day complex demands of **AIRCRAFT ADJUSTABLE BLADE PROPELLERS, MARINE DIESEL ENGINES** — both propulsion and auxiliary power, **DIESEL POWER PLANTS, HYDRO POWER PLANTS, STEAM POWER PLANTS.**

3. We have a technical and production staff of the highest calibre.

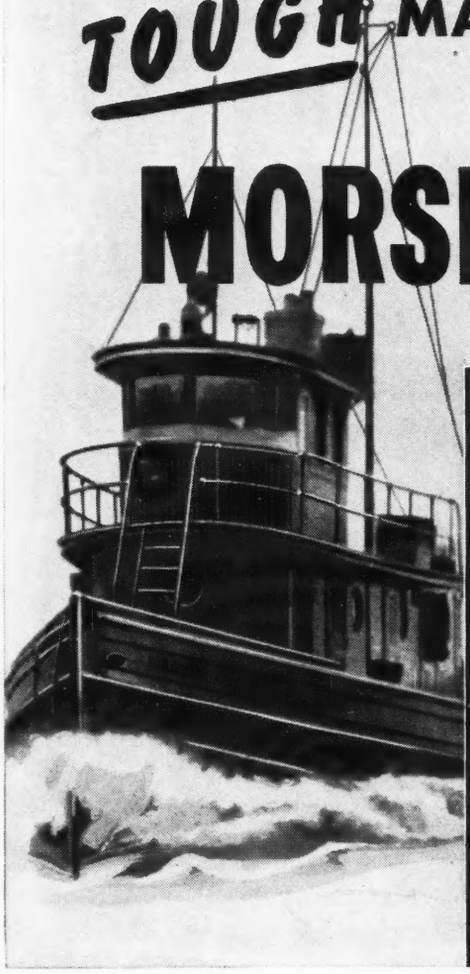
4. Our plant and production machinery are the finest available.

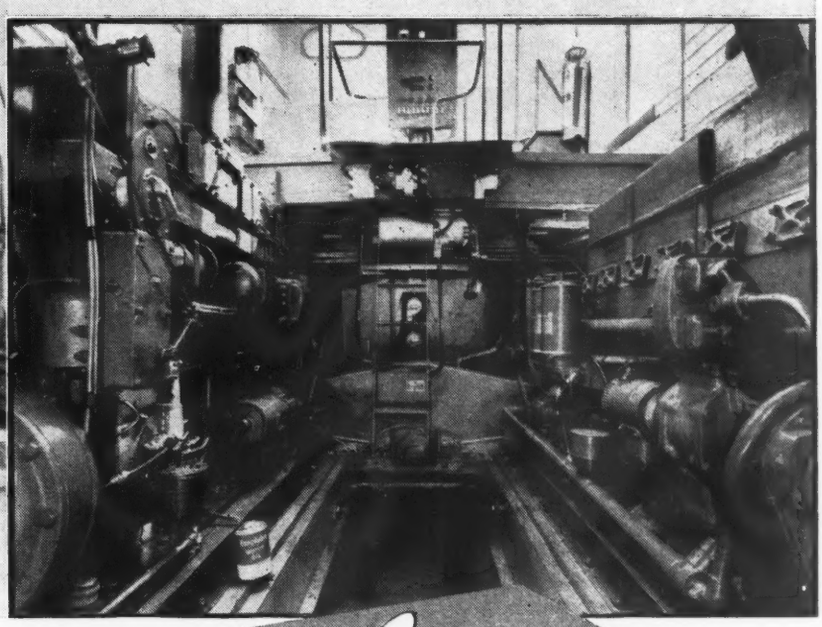
5. Seventy-three years of effort have been concentrated on precision speed and load control problems, which has made us the recognized leader in this field.

WOODWARD

WOODWARD GOVERNOR COMPANY
ROCKFORD, ILLINOIS, U. S. A.

TOUGH MARINE POWER PROBLEM Easily Solved with MORSE ROLLER CHAIN MARINE TRANSMISSION





RECENTLY, the Loveland Towing Company, of Philadelphia, who operate a fleet of tugs between Florida and Boston, had what they considered a tough power problem. Their tug, "Maguire", after years of service under its original steam power, was to be converted to diesel propulsion. The owners turned to Buda Diesel Engines and together, with the use of Morse Chains, they worked out a simple, practical and efficient dual drive diesel installation. Two Buda Diesel Engines were connected to propeller shaft through enclosed Roller Chain Drives run in oil. Today, the "Maguire" is in twenty-four hour service, seven days a week. Records show a reduction of 50% in operating cost with greatly increased pulling power.

This is further proof of the stamina and flexibility of the chain drive that cannot slip or waste power. They roll quietly through shocks, overloads, reverse speeds easily and dependably. You, too, can benefit from the efficient power transmission of Morse Chain Drives. Get in touch with your local Morse man today—he is a power transmission expert.

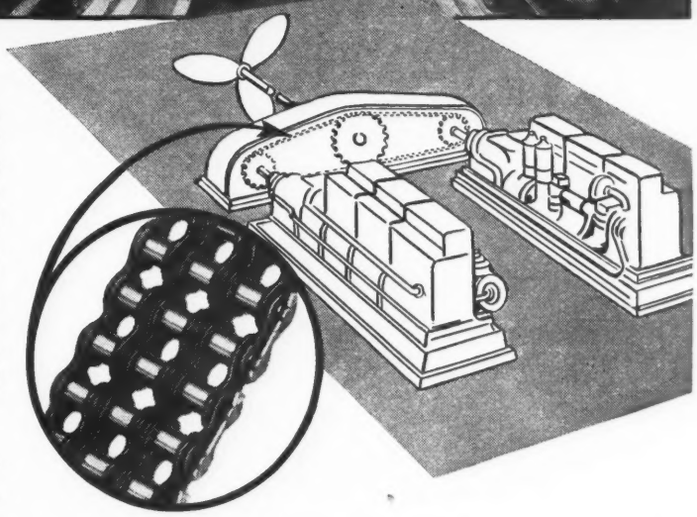


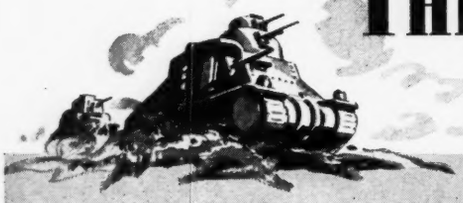
Illustration above shows simple parallel arrangement of two Buda Diesel Engines connected to propeller shaft with encased Morse Chain Drive. The 2:1 reduction in this drive unit, together with that of the reduction gear, gives a total of 4:1 between engine r.p.m. and propeller shaft speeds.

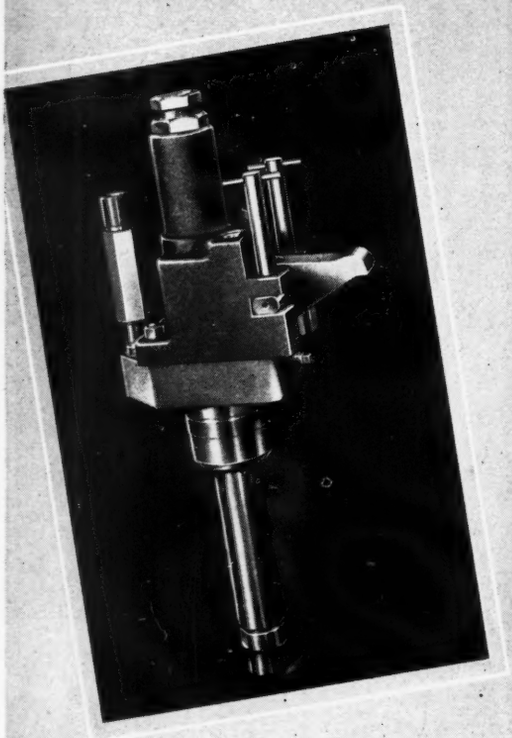
SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

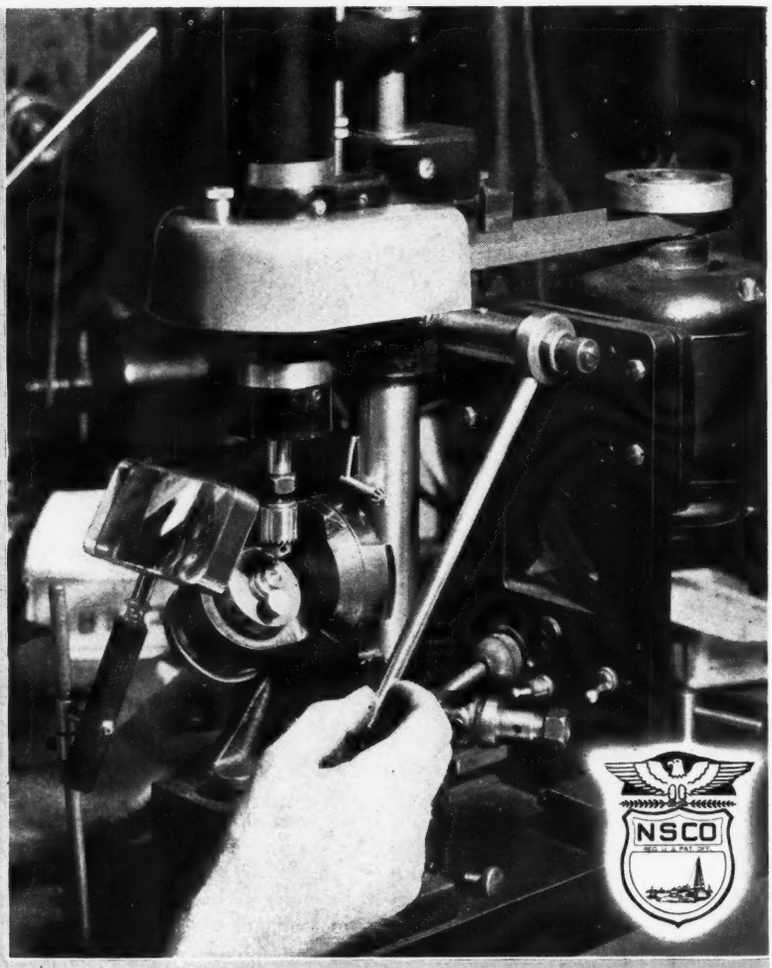
MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

THE MAN-MADE ARTERIES OF HORSEPOWER . . .







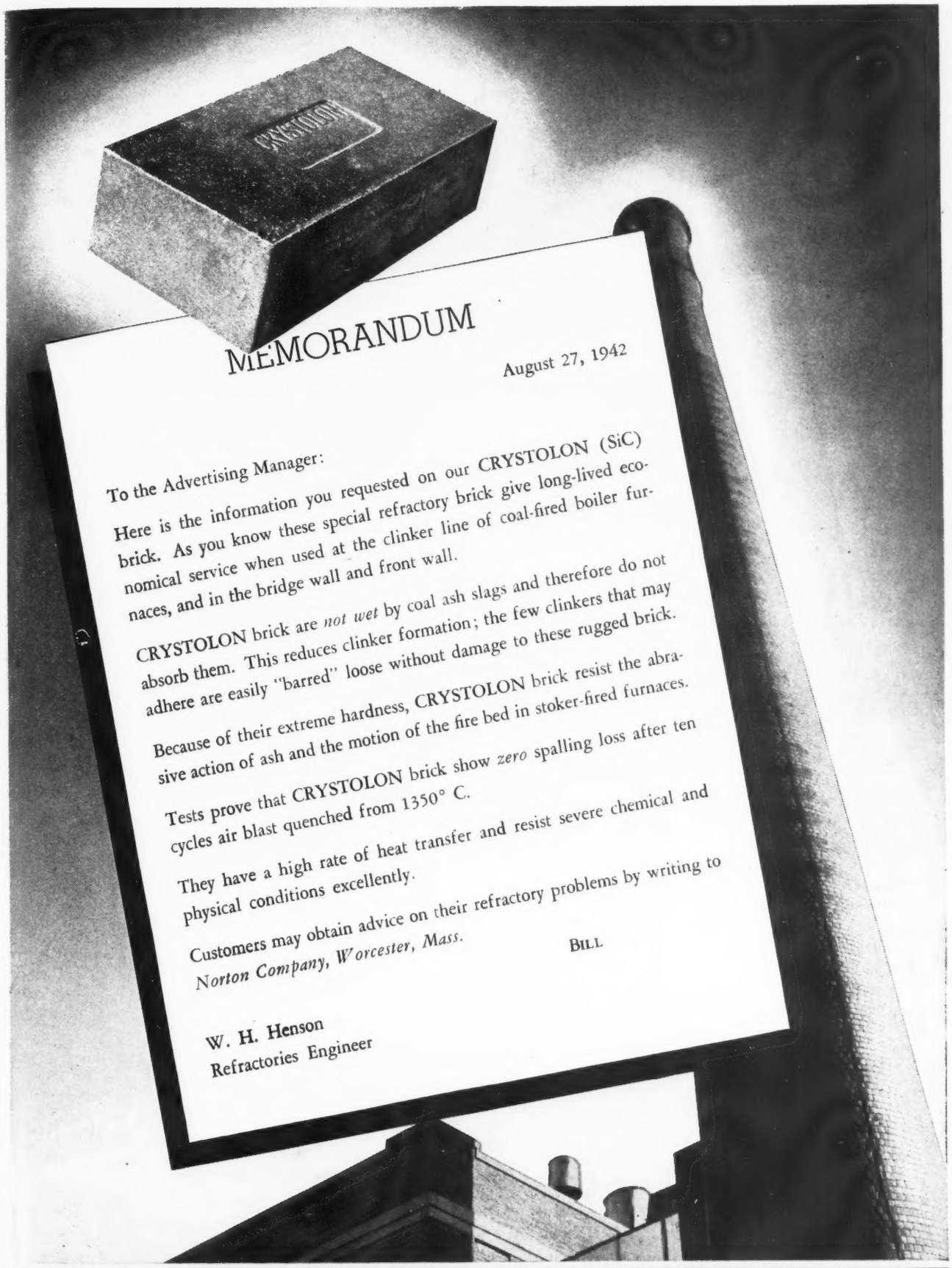
WITH a drill slightly larger than a human hair, craftsmen complete the arterial system through which the fuel oil in your Superior Diesel Engine is conveyed to its ultimate purpose—*the creation of Horsepower.*

War and its insatiable appetite for Horsepower has imposed an unprecedented demand on the skill of these craftsmen. As they build for Victory, they solicit your cooperation in maintaining the full efficiency of your Superior Diesel Engine by giving the proper care and attention to its fuel system.

Spray valves are of particular importance. They are manufactured of critical materials—materials that are most difficult to obtain even with the highest of priorities. Keep them clean and in proper adjustment to insure long life and efficient performance.

SUPERIOR ENGINE DIVISION . . . THE NATIONAL SUPPLY COMPANY

SALES OFFICES: Springfield, Ohio; Philadelphia, Penna.; New York, N. Y.; Los Angeles, Calif.; Jacksonville, Fla.; Houston, Texas; Chicago, Ill.; Fort Worth, Texas; Tulsa, Okla.; Boston, Mass. FACTORY: Springfield, Ohio


CRYSTOLON
MEMORANDUM
August 27, 1942
To the Advertising Manager:
Here is the information you requested on our CRYSTOLON (SiC) brick. As you know these special refractory brick give long-lived economical service when used at the clinker line of coal-fired boiler furnaces, and in the bridge wall and front wall.
CRYSTOLON brick are *not wet* by coal ash slags and therefore do not absorb them. This reduces clinker formation; the few clinkers that may adhere are easily "barred" loose without damage to these rugged brick.
Because of their extreme hardness, CRYSTOLON brick resist the abrasive action of ash and the motion of the fire bed in stoker-fired furnaces.
Tests prove that CRYSTOLON brick show *zero* spalling loss after ten cycles air blast quenched from 1350° C.
They have a high rate of heat transfer and resist severe chemical and physical conditions excellently.
Customers may obtain advice on their refractory problems by writing to *Norton Company, Worcester, Mass.*
BILL
W. H. Henson
Refractories Engineer

NORTON ELECTRIC FURNACE FUSED REFRACTORIES

The hand that rules the paper rocks the world

A SILENT, terribly significant battle is being fought, about which we hear and see very little.

It is the battle of Design.

It can win, or lose, the war, because all production, all transportation, all mechanized and explosive conflict depend upon it.

"Design Engineer" is the modern name for the scientific descendants of men like Eli Whitney and Cyrus McCormick. America probably has more highly trained Design Engineers than the rest of the world combined.

▶ The enduring confidence in final victory, which survives even the worst battle news, is based upon the knowledge that America excels in inventive skill.

But U. S. Design Engineers had a late start. Enemy draughting boards were plotting today's battle machines while ours were blithely inventing and improving the thousands of mechanical aids for work and play which characterize American life.

Lost time is being made up. Research and design on weapons and machines which took years in enemy countries are compressed into weeks by sheer force of numbers of skilled minds, patriotically working without regard to hours or fatigue.

The men who put on paper the intricate mechanisms of our continuous strip steel mills, harvesting combines, gang drills and juke boxes are learning the science of war designing.

They are learning it the hard way, as all citizens of peace-minded democracies must. But we have new factories, new production machines, new ship construction methods, new tanks, bombers and thousands of other processes and devices to prove they are doing their job well.

▶ Because American Industry had built up its great staff of mechanical engineers; because no other nation can match our skill in design engineering, the United States is winning the silent battle of Design.

But designs must be improved constantly. It is estimated that at least 12,000 members of this army of engineers are at work on improvements in military planes alone.

Into a recent improvement of an American tank went 900 pounds of blueprints, representing the work of a segment of this army of brains. Each day brings these more potent weapons closer.

Design Engineers are responsible for new planes of plywood and of steel.

To save brass and copper, some of these Design Engineers developed new uses for plastics.

▶ 700 million additional pounds of magnesium were needed, so some of them designed equipment to get it from plain seawater. The plants are at work.

Because of a new method of producing more powerful gasoline, Design Engineers were able to start plans for an airplane engine of 3,000 h.p. Engines up to 2,000 h.p. are already in production.

Design Engineers took the hand-fitted, laboriously-built Rolls Royce aviation engine and worked out machines and methods to produce it to closer tolerances and in amazing quantities.

Tens of thousands of instances of paper-work that will save American lives and win future battles could be given.

The Design Engineer is the product of the American Industrial System. He is available in war, because his skill was fostered and developed in peace, out of the ploughed-back profits of business.

★ ★ ★

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W. P. B. . . . this advertisement is published by the McGraw-Hill Network of Industrial Communications.

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET . . NEW YORK

When You See ⟵ This in the Newspapers Remember This ⬇

AMERICAN Business Management can work miracles of war production because American business has evolved methods through which the sum of genius can be greater than the sum of its parts.

If individual brilliance alone were the secret, airplanes would have soared over the Acropolis of Ancient Greece. There have always been bright minds.

▶ Industrial progress started when men began to share their ideas—when the inter-change of experience replaced the old habit of hoarding techniques.

In America, methods of interchanging ideas between all production men had reached a high degree of perfection long before war placed its gigantic challenge.

Thousands of conventions, industrial clinics, plant visitation groups, patent pools and other means of swapping ideas were in constant use.

Underlying and supporting this continuous trading of "know-how" was the Industrial Press developed in America to a far greater degree than anywhere else on earth.

Design Engineers, like everybody else in United States production, depend upon Industrial Magazines to keep them from wasting time on problems that somebody else has already solved.

For this reason, every Design Engineer starts each day's work with the advantage of the accumulated experience of a whole nation. He does better work that way.

It's important for every key man in your organization to have his own copy of each industrial magazine that can help him do a better job. The few dollars saved in routing single copies around the plant may be robbing your men of valuable experience records.

For impartial and experienced help in surveying your actual needs in Industrial Magazine subscriptions write to the Reading Counsellor, McGraw-Hill Publishing Company.

★ ★ ★

THE McGRAW-HILL NETWORK

More than 1,000,000 of the executives, designers and production men who give America her world supremacy in technical "know-how," use the editorial and advertising content of the 23 McGraw-Hill publications as a means of exchanging ideas.

THE McGRAW-HILL BOOKS

Technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL PUBLICATIONS

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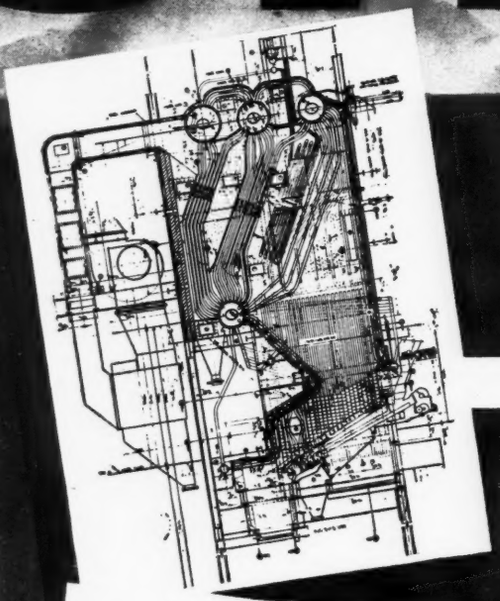
Business Week	Electrical Merchandising	Engineering News-Record	Textile World
Chemical & Metallurgical Engineering	Electrical West	Factory Management & Maintenance	Transit Journal
	Electrical World	Food Industries	Wholesaler's Salesman

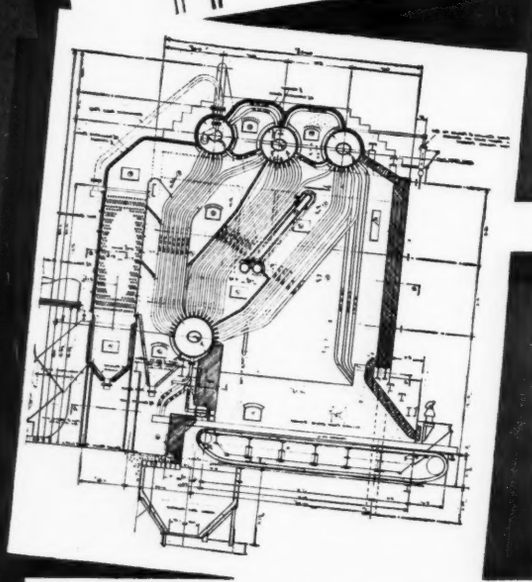
STEAM *for*



POWER

SOUTHERN COLORADO POWER COMPANY
Pueblo, Colo.

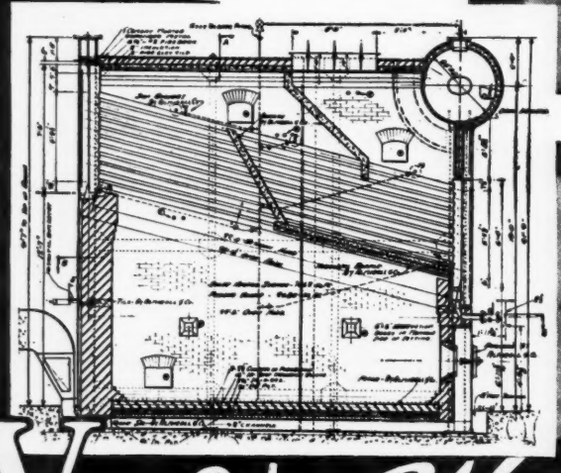
90,000 lbs. steam per hour Vogt LE type bent tube boiler with underfeed stoker. Water walls and economizer. Design pressure 525 lbs. Total steam temperature 750 degrees F.



PROCESS

IN A LARGE MID-WESTERN STEEL MILL

Two 105,000 lbs. steam per hour Vogt LE type bent tube boilers with chain grate stokers and economizers. Design pressure 225 lbs. Total steam temperature 550 degrees F.



HEATING

CRIMINAL COURTS BUILDING AND JAIL
New York City

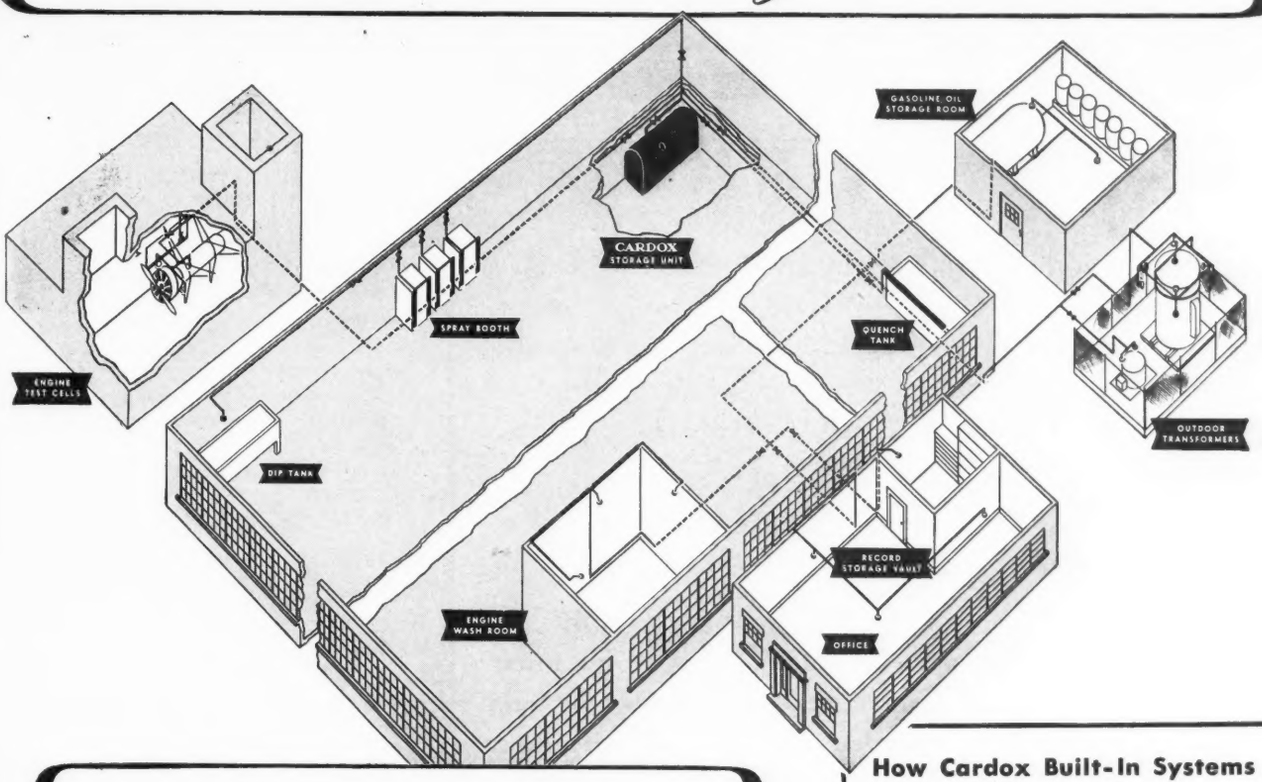
Four Vogt sectional header type boilers of 47,000 lbs. steam per hour capacity, oil fired. Design pressure 200 lbs.

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY
Branch Offices: NEW YORK CLEVELAND CHICAGO PHILADELPHIA DALLAS

Vogt *Water Tube* BOILERS
BENT TUBE AND SECTIONAL HEADER TYPES

A SINGLE SYSTEM

Protecting *One* or *Many* Fire Hazards



CARDOX FIRE EXTINGUISHING SYSTEMS

Flexible! Engineered to Solve Your Specific Fire Problems

Men responsible for uninterrupted war production know the damaging setbacks that can be caused by fire. But the wide variety of hazards, existing in virtually every plant and shop, presents a difficult problem. Adequate fire protection must be provided *for each*. Differences in hazards, floor space, layout and size call for a fire extinguishing system engineered for over-all plant requirements.

Cardox Systems meet that specification fully. The schematic view shown includes a combination of fire problems so diversified as to be met with infrequently in industry. Yet one Cardox System, with its single storage unit, can be engineered to the job. It provides today's sound method of swift extinguishment, with little or no loss, damage or delay to equipment or production.

The flexibility of Cardox Systems permits easy installation in new construction or existing buildings. More data on this and the many other Cardox qualities can be had by writing for Bulletin 992.

CARDOX CORPORATION
BELL BUILDING, CHICAGO, ILLINOIS

District Offices in: New York • Detroit • Pittsburgh • Cleveland
Kansas City • Atlanta • San Francisco • Los Angeles • Seattle

How Cardox Built-In Systems Extinguish Fires

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

CARDOX
NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

You Get Double Life WITH

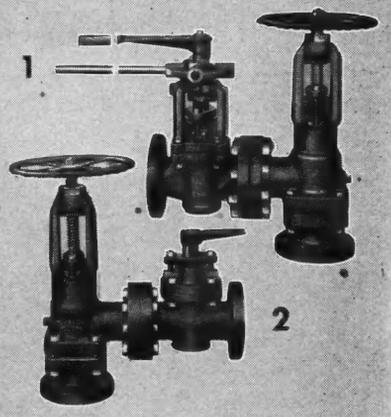
HOVALCO
BLOW-OFF VALVES

● Turn over the seat and disc of any Hovalco Angle Valve, and you have a "good-as-new" valve, ready to give double its length of service. And this *double valve life* is not just double that of an ordinary valve—but double the life of the HOVALCO'S extra-long-wearing Monel Metal seat and disc.

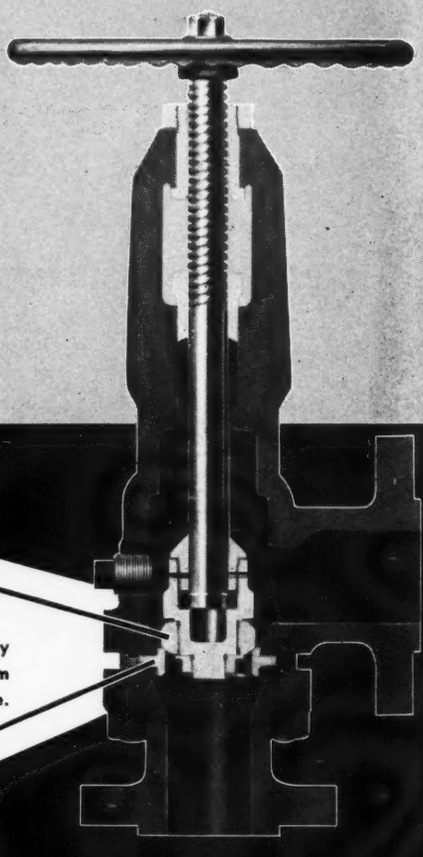
In addition, certified performance facts from users show that Homestead Boiler Blow-Off Valves give 30% to 60% lower maintenance costs.

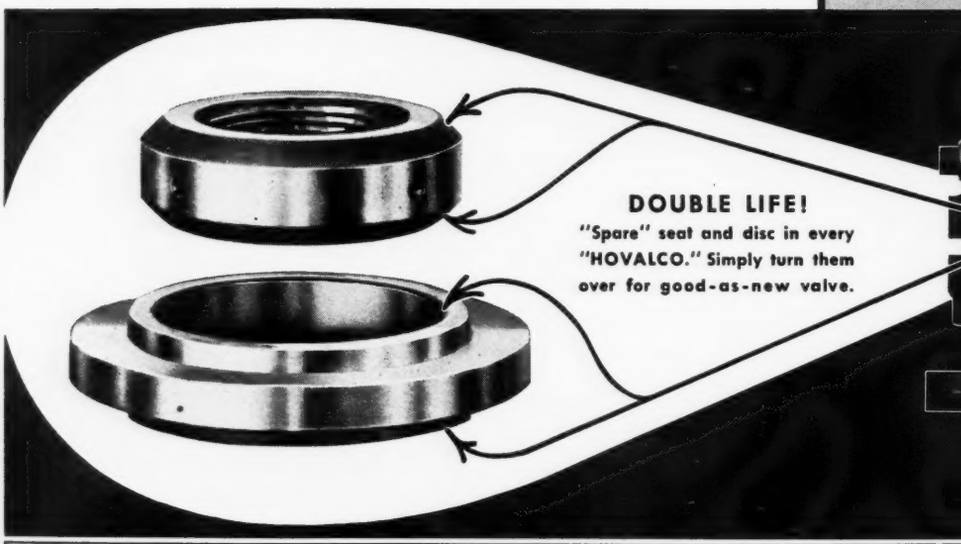
Here then is one sure way of meeting today's steadily increasing power demands with unfailing service and lower costs. Specify and order Homestead Valves for your next blow-off job; and for prompt delivery, please send the highest possible priority rating along with your order.

The proper size and type for your service conditions will be found in Reference Book No. 38. Write for it.



Hovalco Angle Valves, used in combination with (1) Homestead Lever-Seald or (2) Cam-Seald Quarter-Turn Valves, meet the requirements of A. S. M. E. Code and all state laws for boiler blow-off service. Made in 1½", 2" and 2½" sizes for pressures to 600 pounds.





DOUBLE LIFE!
"Spare" seat and disc in every "HOVALCO." Simply turn them over for good-as-new valve.

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Expansion of small plants swelling Nation's Power Output

Carey HEAT INSULATIONS PROVING BIG FACTOR IN WARTIME EFFICIENCY

Small industrial communities all over America are feeling the demand for more and more power. And it is the expansion of plants in these towns that has accounted for much of the increased power output of the nation.

A typical example is Decatur, Indiana, where power demands by local industries made necessary a $500,000 expansion program by the Decatur Municipal Light & Power utility. The added facilities include a new 5,000 kilowatt turbine generator and a 775 hp. boiler unit.

It is significant of the widely recognized quality of CAREY Insulations that the supervising engineers, Froehlich & Emery, Toledo, specified these products exclusively. The "quality" of CAREY Insulations means more than high efficiency—more than durability. It is insurance of maximum conservation of fuel—dependable performance for the maximum period of time.

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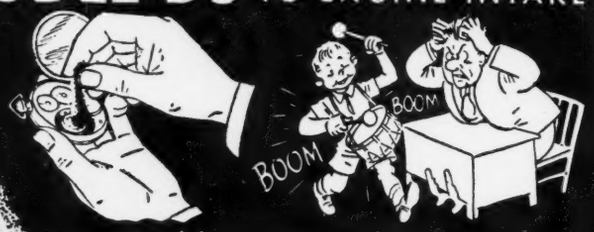
at Maximum Output—with Minimum Trouble

The chips are down. American industry faces its most crucial test. Production facilities are strained to the utmost as governmental and civilian orders pile up. Equipment must be at peak efficiency. Be sure all compressors, pumps and internal combustion engines are equipped for maximum output, minimum maintenance. Equip each one NOW with Protectomotor Intake Filters. Stop trouble where it frequently starts—in abrasive dust that wears reciprocating parts and clogs valves, reducing production as it increases chances for trouble. Keep 'em running, America—equip with Protectomotors NOW!

MODEL DS SILENCES, FILTERS AIR TO ENGINE INTAKE



You wouldn't permit this . . . or this

WHY

LET UNPROTECTED INTAKES DRAW IN DUST . . . CAUSE EXCESSIVE NOISE?

The Model DS Protectomotor is the only device that not only prevents the intake of dust to air-breathing machines, but also silences the intake sound.

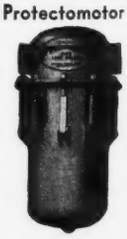
Construction is simple, rugged and effective, possessing many exclusive, patented features and special advantages:

A. Series of cylindrical rectifying chambers of scientific diameter to length ratio which smooths out sound waves.
B. Dry Feltex Filtering Medium more than 99% efficient by University of California Laboratory tests.
C. Radial Fin Construction. Permits large area of filtering medium to occupy smallest possible space.
D. Rigid, galvanized mesh frame.
E. Reinforcing tube. The Model DS Protectomotor is "built like a battleship."

AIR, GAS & LIQUID LINE FILTER

Exclusive Radial Fin Construction provides large filtering area in relation to space required. Thousands used in industry since 1920.

Staynew Representatives in Principal Cities



WRITE FOR CATALOG describing filters for engines, pipe lines, ventilation, etc.

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PROTECTOMOTOR AIR FILTERS 99 9/10 Per Cent efficient

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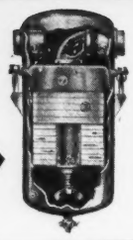
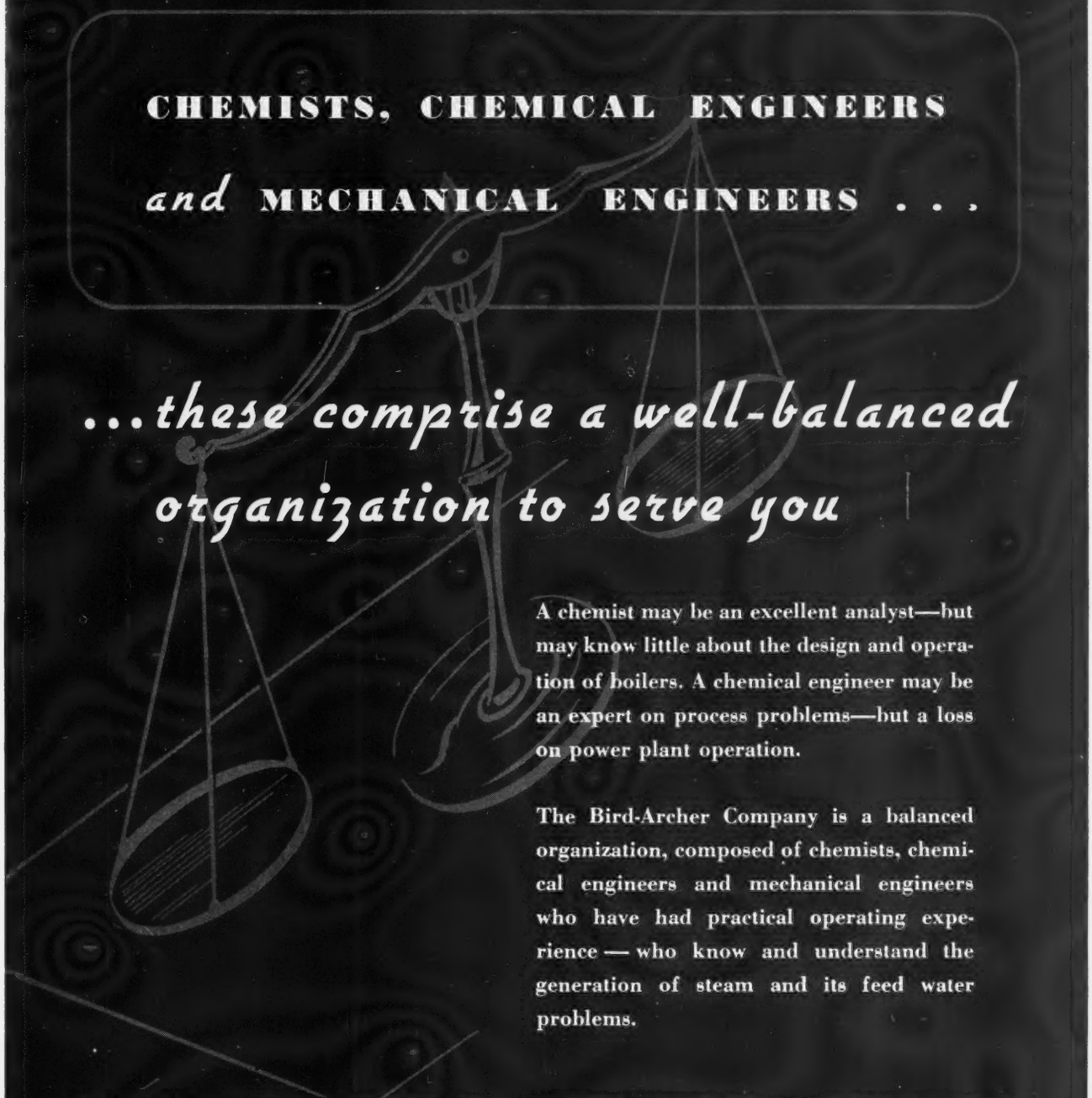


SLIGHTEST TRACES OF OIL REMOVED FROM AIR TRANSMISSION LINES WITH LATEST PROTECTOMOTOR, MODEL AAPHS PIPE LINE FILTER. Staynew engineers have designed an entirely new type of pipe line filter, now used extensively for the protection of delicate air-powered control devices. This new filter, the Model AAPHS, prevents the passage of the most minute traces of vaporized oil. The AAPHS is actually a "super" filter, used in most applications as the final of two or more stages of filtration.
Construction Features: (1) inlet; (2) baffle; (3) solid Feltex Disc through which all air must pass; (4) carrier tube; (5) outlet; (6) shell; (7) drain cock.

CHEMISTS, CHEMICAL ENGINEERS

***and* MECHANICAL ENGINEERS . . .**



. . . these comprise a well-balanced organization to serve you

A chemist may be an excellent analyst—but may know little about the design and operation of boilers. A chemical engineer may be an expert on process problems—but a loss on power plant operation.

The Bird-Archer Company is a balanced organization, composed of chemists, chemical engineers and mechanical engineers who have had practical operating experience — who know and understand the generation of steam and its feed water problems.

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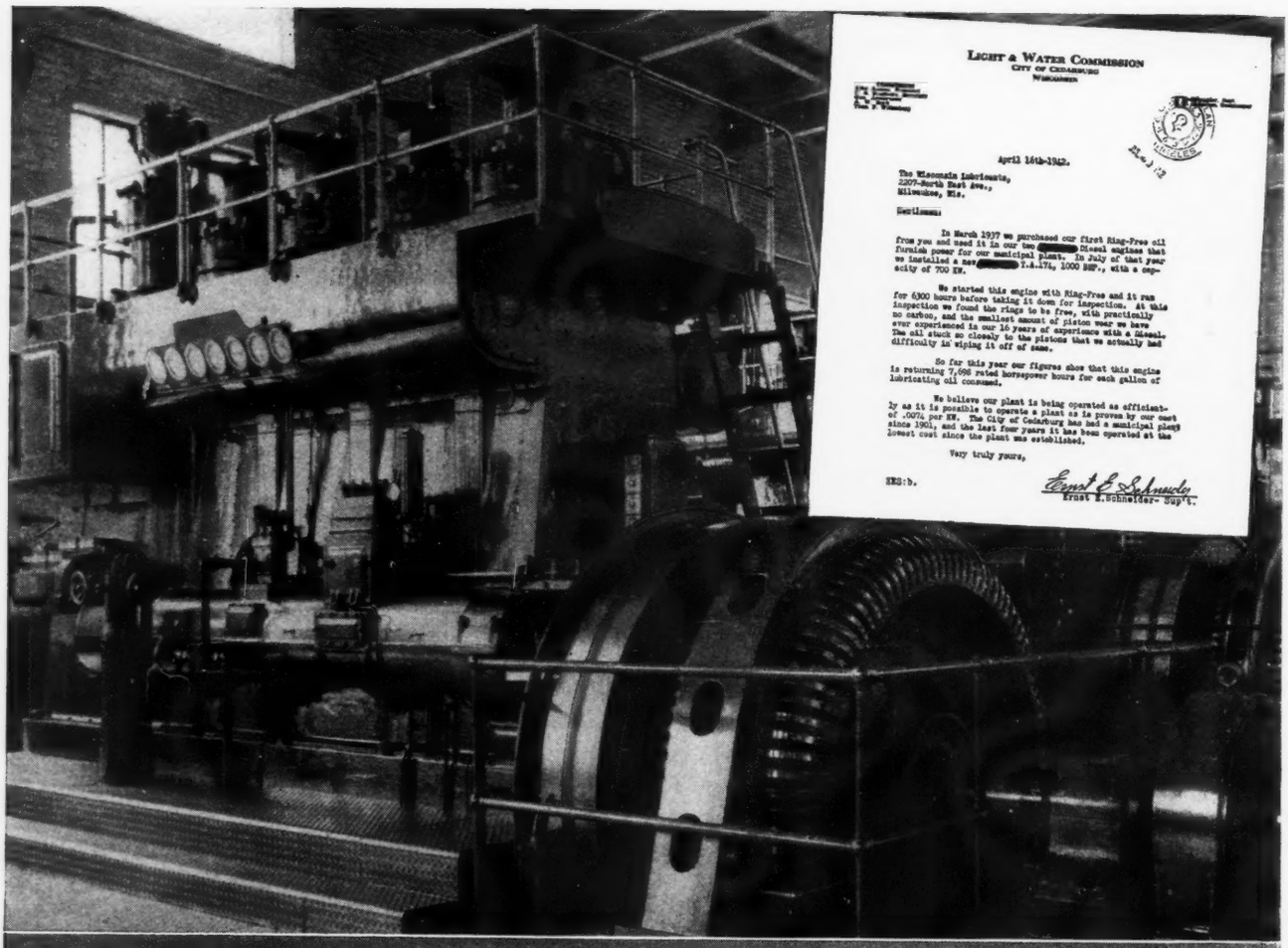

LIGHT & WATER COMMISSION
CITY OF CEDARBURG
WISCONSIN

April 16th-1942.

The Wisconsin Lubricants,
2207-North East Ave.,
Milwaukee, Wis.

Gentlemen:

In March 1937 we purchased our first Ring-Free oil from you and used it in our two [redacted] Diesel engines that we installed a new [redacted] I.H.P., 1000 RPM., with a capacity of 700 KW.

We started this engine with Ring-Free and it ran for 6300 hours before taking it down for inspection. At this inspection we found the rings to be free, with practically no carbon, and the smallest amount of piston wear we have ever experienced in our 16 years of experience with a Diesel. The oil stuck so closely to the pistons that we actually had difficulty in wiping it off of same.

So far this year our figures show that this engine is returning 7,698 rated horsepower hours for each gallon of lubricating oil consumed.

We believe our plant is being operated as efficiently as it is possible to operate a plant as is proven by our cost of .007¢ per KW. The City of Cedarburg has had a municipal plant since 1901, and the last four years it has been operated at the lowest cost since the plant was established.

Very truly yours,

HEB:b.

Ernst E. Schneider
Ernst E. Schneider- Supt.

1 Gallon to every 7,698 H.P. hours

THAT'S the average oil consumption recorded by The City of Cedarburg, Wisconsin so far this year.

The experience of the Light & Water Commission of Cedarburg is the subject of an article in August Diesel Progress where detailed figures, giving full credit to RING-FREE are given.

"The results have surpassed expectations," says Diesel Progress. "Not once in all the years of operation have the operators found a stuck ring. Careful records are kept of all maintenance work and they show that cylinder wear has been exceedingly small."

The Cedarburg authorities give a striking instance of the performance of RING-FREE in their letter of April 16, 1942. They started a new engine with RING-FREE "and it ran for 6300 hours before taking it down for inspection. At this inspection we found the rings to be free, with practically no carbon, and the smallest amount of piston wear we have ever experienced in our 16 years of experience with a Diesel," says Ernst E. Schneider, Superintendent.

Read the complete story in Diesel Progress for August, then write us.

MACMILLAN
PETROLEUM CORPORATION
50 West 50th Street, New York
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RING-FREE
MOTOR OIL
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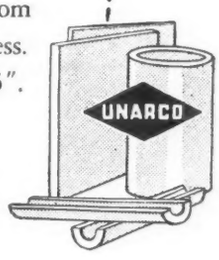
Unibestos sectional pipe covering is available in either Standard (750° lmt.) or Super (1200° lmt.) material or any combination of the two for intermediate temperatures in single layer construction, with provision for expansion where required—permits reduced inventories. Unibestos greater structural strength is unaffected by vibration—will not soften, shatter or shake-down, even under severe conditions. It saws or cuts clean and sharp with ordinary tools—eliminates waste of material in applying. Unibestos is available up to 30″ pipe diameter in half sections, and from 31″–60″ in quadrants from ¾″ to 5″ in thickness. Sheets are available in sizes up to 36″ x 36″ x 5″.



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FOR INSULATION USERS

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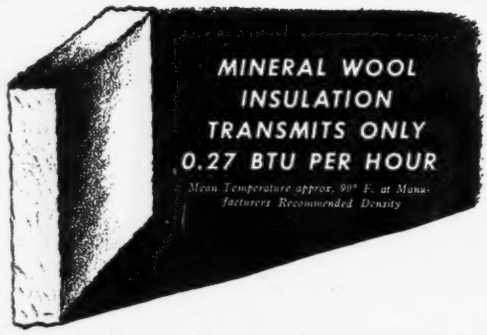

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BOILERS
Must Breathe

• Blackout or no blackout, the power must go on! Buffalo Special Disk Fans are helping power plants meet the problem of light-sealed windows, doors, ventilators and louvers. In conjunction with hooded ventilators, these efficient Buffalo Fans are supplying boiler rooms with air on a large-volume scale—ample air for boiler draft during blackouts.

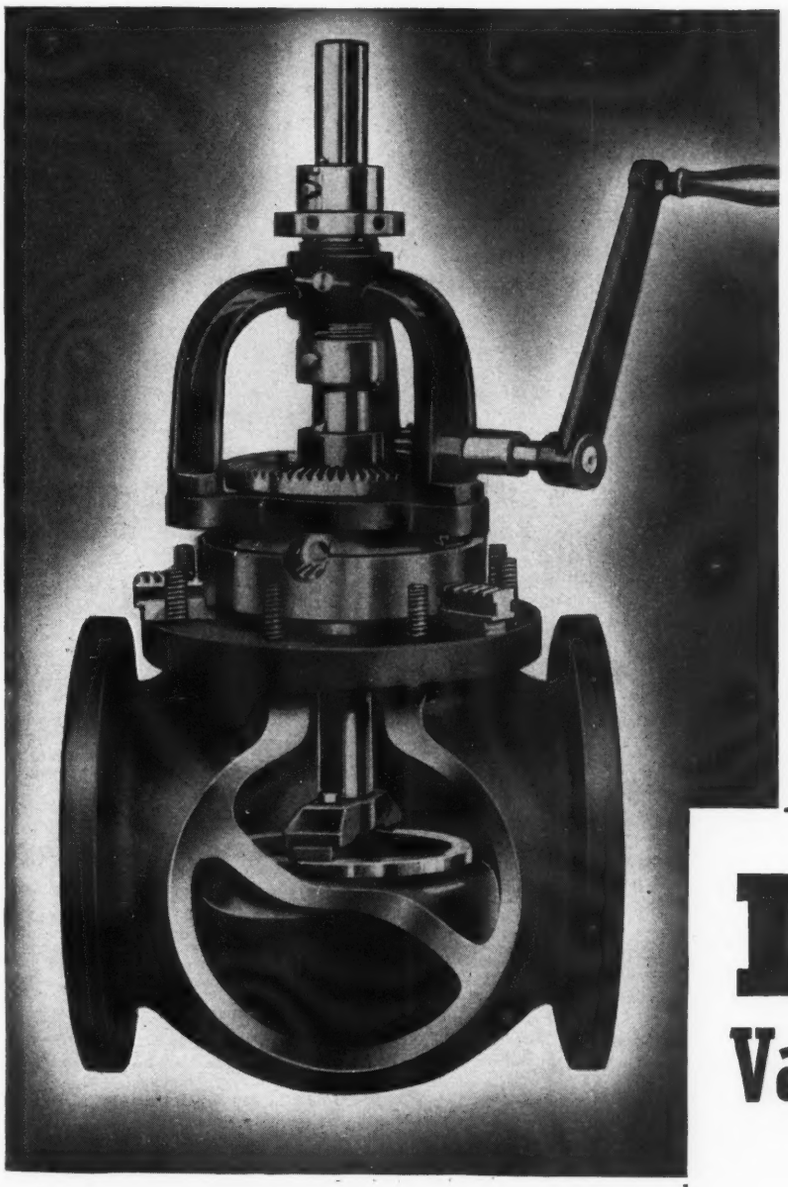
BUFFALO FORGE COMPANY
488 Broadway **Buffalo, N. Y.**

Branch Engineering Offices in Principal Cities
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" FANS

Dexter Equipment will quickly Reseat

Any Valve... Any Make... Any Metal...



In times like these — when new valves or valve parts are difficult or impossible to obtain — here is good news:

- —any mechanic using Dexter Valve Reseating Equipment can reseat any valve made by any valve manufacturer of any metal.
- —the seat and disc or gate will be pressure tight.
- —all work can be done without removing valves from the line.
- —the equipment quickly pays for itself, frequently within a few months.

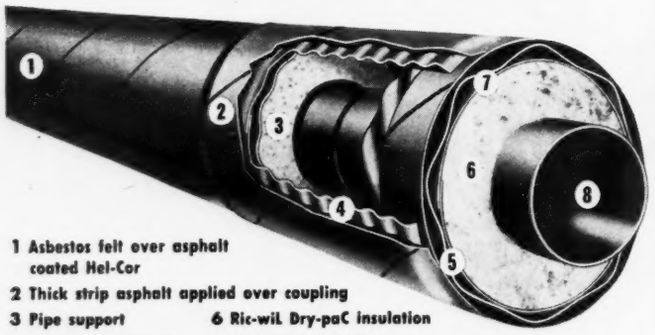
Put an end to leaky valves in the line and salvage old valves from the scrap pile. Write today for descriptive bulletins and complete information.

Dexter Valve Reseating Machines

CAPACITIES: *Globe Valves, 1/4" to 14"; Gate Valves, 1 1/2" to 48"; Pump Valves, 2" to 15".*

THE LEAVITT MACHINE CO., 508 EAST RIVER STREET, ORANGE, MASSACHUSETTS

SPEED ON UNDERGROUND • PIPING JOBS! •



1 Asbestos felt over asphalt coated Hel-Cor
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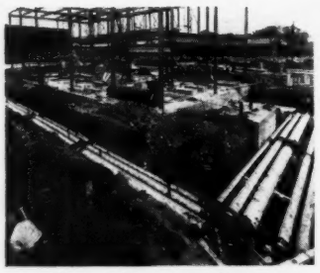
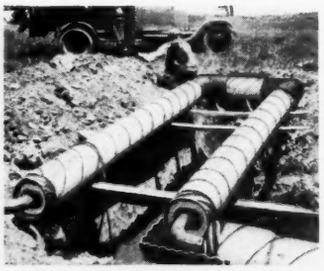


Lines at Great Lakes Naval Training Station.



Expansion loop. Note sliding type pipe supports.

Speed is the prime requisite on wartime construction. Use Ric-wiL Pre-sealed Insulated Pipe Units for the protection and insulation of all underground and outside overhead steam, fuel oil, and hot water piping. These factory pre-fabricated units are reasonable in cost. Note these salient facts:

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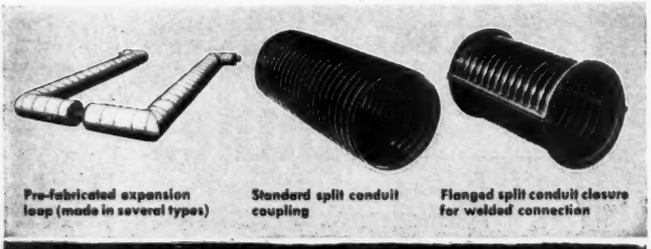
- ★ Engineering experience places a *minimum* service life on these units at 40 years.
- ★ Your job is water-tight and gives high operating efficiency.
- ★ Over a million feet now installed, mainly for National Defense purposes.

Write for latest Catalog "S". For Engineers engaged on war projects only, we have a special engineering Manual 420A, sent on request.



Pre-fabricated expansion loop (made in several types)

Standard split conduit coupling

Flanged split conduit closure for welded connection

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THE RIC-WIL CO., CLEVELAND, O.
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Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

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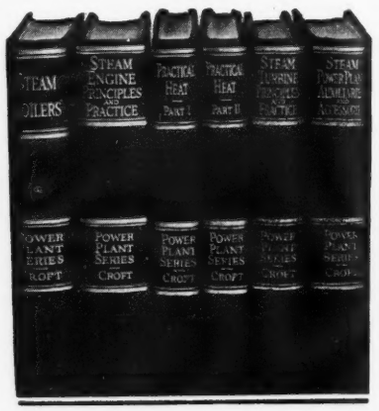

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THE ONLY STOKER WITH THIS COMBINATION OF VITAL FEATURES

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HYDRAULIC AND STEAM DRIVE

are manufactured by

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1842–1942 **Baltimore, Md.**

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★★ There is an "F & E" Underfeed Stoker for every boiler that produces from 1,000 to 40,000 lbs. of steam per hour for power or heat—industrial or commercial. Complete literature available. ★★

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By Removing Scale

Today's efforts are putting every boiler to a severe test. You can keep that boiler efficient and protect valuable tubes by proper cleaning. Scale can be removed quicker with Airetool Tube Cleaners because the unusually powerful motor will operate a wide variety of cutter head combinations.

Maintenance cost is low because the carefully selected alloy steels are heat treated by a special process that increases their life. Motors are precision built and are of slip fit construction for quick reassembling.

Sizes of Airetool Tube Cleaners are made for tubes $\frac{1}{2}$" to 20" I.D.; straight or curved; air, steam or water driven. Heads are made for every coke condition. Airetool New Form Cutters prevent cracking.

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Removal of two bolts frees the top cap—and the valve and seat are completely exposed to view.

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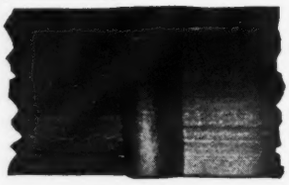
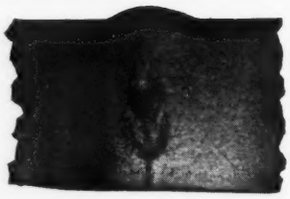


100%
penetration



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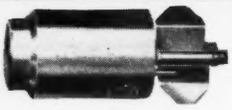

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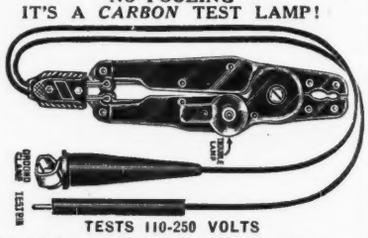

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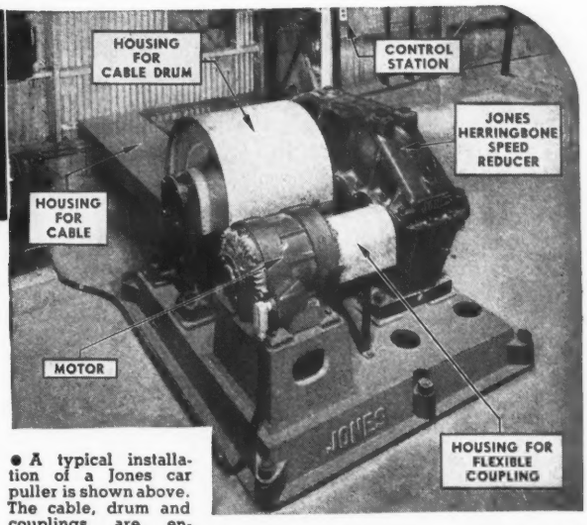
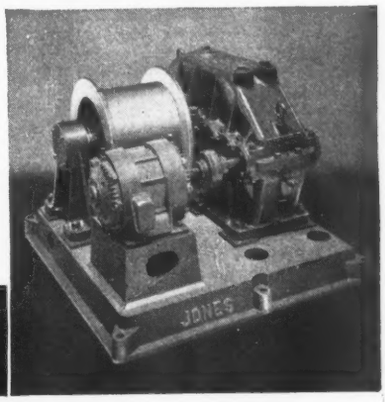


● A typical installation of a Jones car puller is shown above. The cable, drum and couplings are enclosed by sheet metal housings as an extra precaution in this installation to eliminate all hazard from moving parts.



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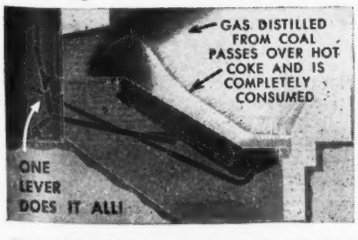

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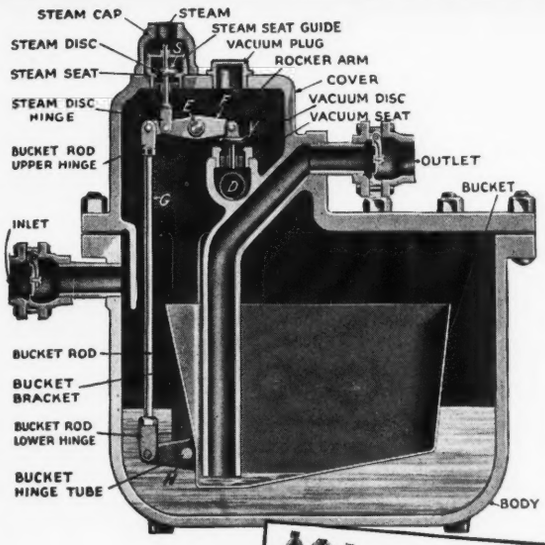

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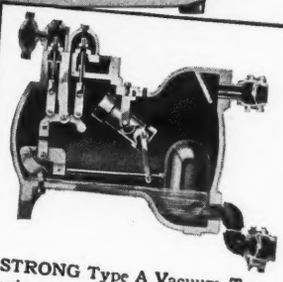

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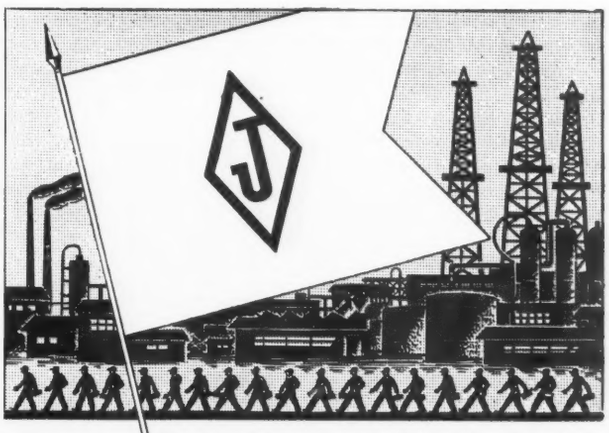

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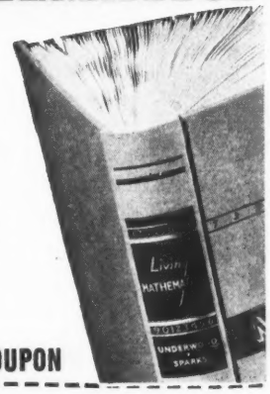

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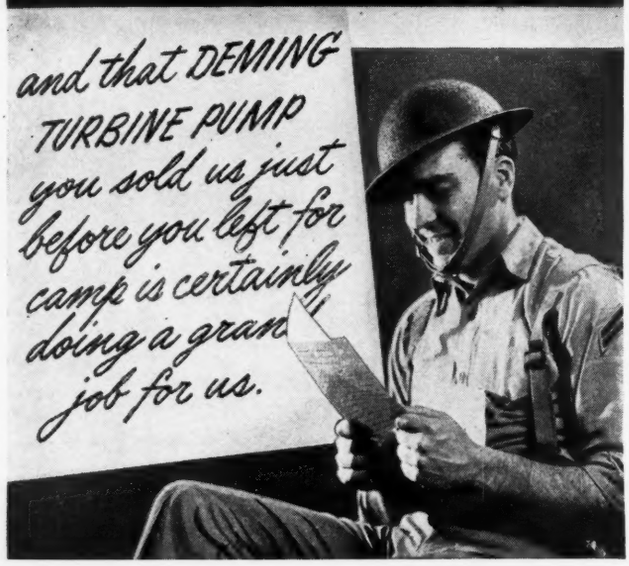

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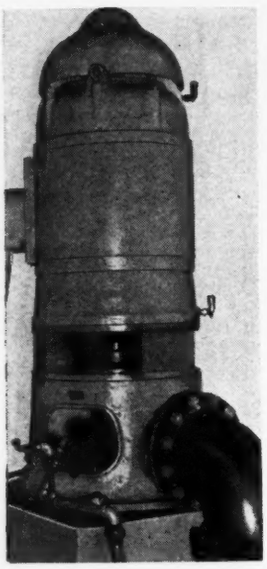

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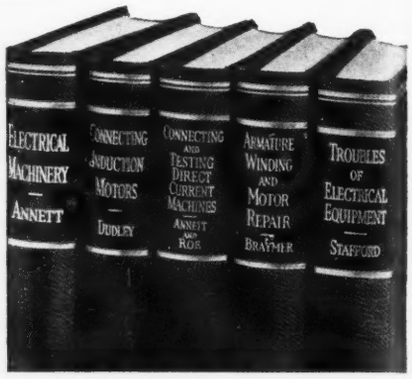
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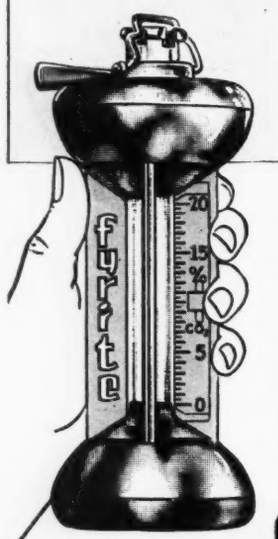

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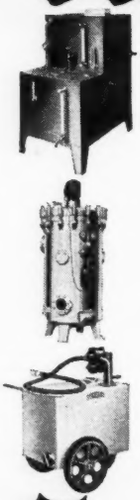

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The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by September 11 will appear in the October issue, subject to limitations of space available.

POSITION VACANT

LARGE SOUTHERN New England industrial company operating own power plant is seeking night power plant supervisor. Must be United States citizen, preferably between 35 and 40 years of age, with suitable experience in public utility, or large industrial plant, on electrical generation, steam and air units. Write P-308, Power, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

POSITION WANTED

MECHANICAL ENGINEER. Age 36. Graduate. Offers 13 years of extremely broad experience all phases steel mill and power plant engineering. Desires position of plant or power engineer. Minimum salary $6000. Now employed. Address PW-299, Power, 520 N. Michigan Ave., Chicago, Ill.

CHIEF OPERATING ENGINEER — Thirty years experience covering a very wide range of training in the operation and maintenance of utility central stations, substations and industrial power plants. Thoroughly familiar with H.P. Pulverizer and stoker fired boilers. Technical school graduate. Many years in responsible supervisory positions. References furnished. PW-301, Power, 330 W. 42nd St., New York, N. Y.

REPRESENTATIVES WANTED

Established engineering company producing supplementary power plant equipment desires additional representatives. Reply to

R.W.-302, Power
330 West 42nd St., New York City

WISCONSIN FIRM
of MANUFACTURERS AGENTS
desires an additional line of Reliable Steam Equipment such as Valves, Traps, Etc.

Write
RA-303, Power
520 No. Michigan Ave., Chicago, Ill.

Don't forget the
Box Number

WHEN answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

WORK WANTED

SQUAD OF ENGINEERS, capable of handling Design and Drafting on power plants, and chemical or oil refineries. Wish to handle complete project as a group. WW-304, Power, 68 Post St., San Francisco, Cal.

FOR SALE

ICE CREAM CABINETS $10 up—Compressors $5 up—¼ hp. motors—2 hp. Hobart Mixer—2—12'x20" shell-tube condensors—30 hp. slip-ring—8x8 & 9x9 ammonia compressors—2—Krupp diesels 90 Hp., 3 Cylinders. Kelvinator 1 & 2 hole ice cream cabinets. 4x4 York self-contained ammonia plant. Black & White corporation, 574 West 130th St., New York.

WANTED

USED GATE VALVE RESEATING equipment, all sizes. Leonard & Powers Supply Co., 330 East 53d St., New York City.

WAR CASUALTY

FOR SALE

A group of substantial steel buildings, under one roof, enclosing an area of approximately 132,000 square feet — siding corrugated steel — roofing corrugated asbestos — traveling cranes. Power plant may be included. Approximately one mile of railroad track through and around buildings. Three railroad trunk lines. Adjacent to deep water. Building may remain on present site. For details address P.O. Box 1121, Wilmington, Delaware, or telephone Wilmington 7104, extension A.

PRICE & COMPANY

CONSULTING ELECTRICAL AND MECHANICAL ENGINEERS

Technical Advisers to the Purchasers of Used Steam and Electrical Equipment

Inspection Redesign Reports
Installation Supervision

88 Broad Street, Boston, Massachusetts

ADELBERT B. PRICE
Registered Professional Engineer

FOR SALE

Chuse N.R.C. 17x21 #1075 2300V 200 K.W. Generator and Exciter, Tirrell regulator and rheostats. Good condition, priced reasonably.

FS-305, Power
520 N. Michigan Ave., Chicago, Ill.

IMMEDIATE DELIVERY

Electrical Equipment & Accessories

2—350 H.P. Motors—1775 RPM., 2200 volts, 3 PH., 60 cycles
1—200 H.P. Motor, 1750 RPM., 2200 volts, 3 PH., 60 cycles 40 HP. & 50 HP Motors

Various Elec. Starters—Compensators—Controllers—Switches—Transformers—Conduit Junction Boxes—Insulators—Control Panels—Magnetic Coils

BENJAMIN FOSTER COMPANY

20th & Erie Ave. Phila., Pa.

FOR SALE

BOILER

105 H.P. Double Duty Keeler Boiler, all auto. completely reconditioned 2 years ago. Now operating. Reduced price for quick sale.

GUNTHER WOLFF INC.
Williamsport, Pa.

FOR SALE

1—1000 HP McIntosh Seymour Diesel direct connected to 720 KW GE Generator.
1—750 Busch Sulzer Diesel.
2—300 HP Y.V. Fairbanks Morse Semi-Diesels.
4—75 HP Y.V. Fairbanks Morse Semi-Diesels.
1—300 HP Miller Gas Engine direct connected to 196 KW Generator.
1—400 HP Rathburn Jones Gas Engine.
1—250—1—150 HP Bruce McButh Gas Engines.
1—275 KW Belted Generator.
1—165 HP Foos Gas Engine.
1—150—2—80—2—60 HP Bessemer Gas Engines.
1—250 KVA Murray Corless Steam Unit.

A. C. ASKEW
Box 3073 Whittier Sta.
TULSA, OKLA.

DIESEL ENGINES
BOUGHT—SOLD

One of the Largest Used Stocks in the East. Send us your offerings and inquiries.

ALJON ELECTRIC DIESEL CO.
151-5 Washington St. B'klyn, N. Y.
Main 4-3804-5

FOR SALE

1—100 HP Curtis Steam turbine with 4 to 1 speed reducer on common base.
1—60 HP Terry Steam turbine, 125# steam pressure.
2—Allis-Chalmers single stage centrifugal pumps, 450 GPM, 60 ft. head, 1130 RPM.

RALPH H. ROGERS & CO.
306 Millsaps Bldg. Jackson, Miss.

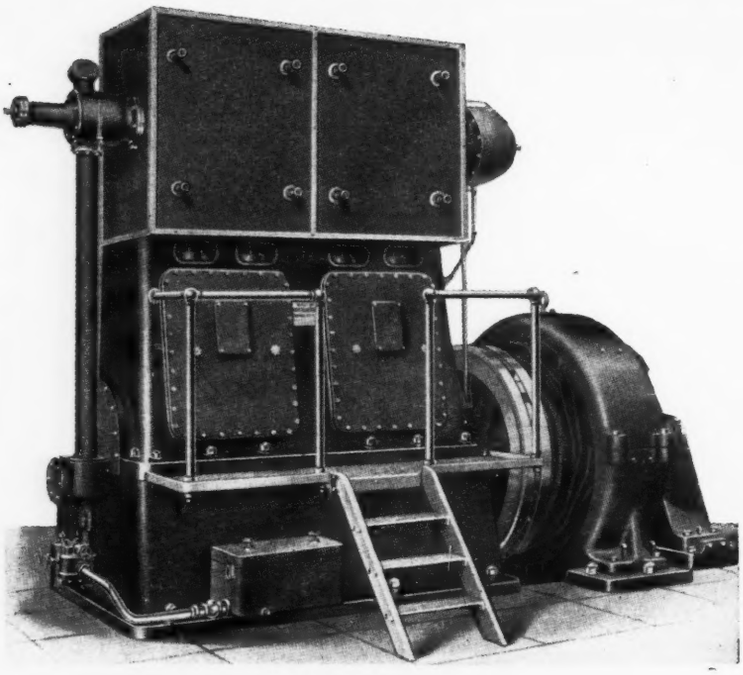
TWO FOSTER-WHEELER SUPERHEATERS

For sale: 120° of superheat when used with 323 hp. boiler operating at 150% rating and steam pressure at 190 pounds and containing not over 1% of water. Blue prints of heaters available.

PET MILK CO.
Arcade Bldg. St. Louis, Mo.

Equipment Wanted — See page 335

ELECTRICAL POWE



Actual Photograph

150 KW CROCKER WHEELER-AMES VERTICAL UNIFLOW UNIT

150 KW Crocker Wheeler direct current generator 125-250 volts 3-wire 360 RPM direct connected to 9" x 11" Ames vertical uniflow engine, 200-250 lbs. Steam pressure 0-8 lbs. back pressure 360 RPM. Equipped with switchboard panel and instruments.

ALTERNATING CURRENT ENGINE GENERATORS

3 Phase 60 Cycle

210 KVA GENERAL ELECTRIC—AMES Uniflow, 125-150 lbs. 0-5 lb. back pressure, 2300/600/480/240 volts

ALTERNATING CURRENT ENGINE TYPE GENERATORS

3 Phase 60 Cycle

1250 KVA ALLIS CHALMERS, 2400/600 volts, 257 RPM

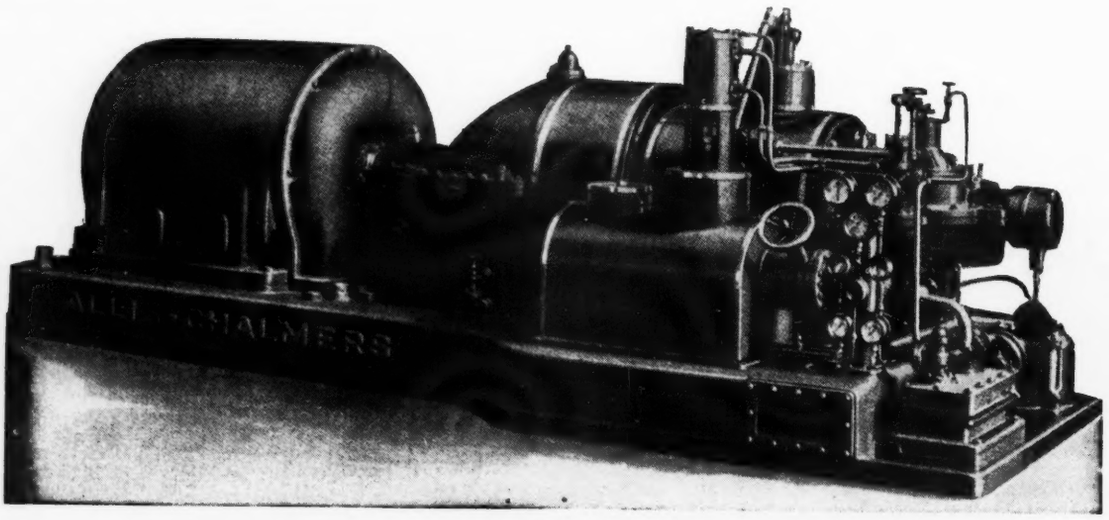
210 KVA GENERAL ELECTRIC, 2300/600/480/250 volts, 225 RPM

DIRECT CURRENT ENGINE GENERATORS

125/250 Volts 3-Wire

150 KW CROCKER WHEELER—Ames vertical Uniflow, 200-250 lbs. 0-8 lbs. back pressure

125 KW CROCKER WHEELER—Ames vertical Uniflow, 200-250 lbs. 0-8 lbs. back pressure



Actual Photograph

1000 KW ALLIS CHALMERS CONDENSING TURBO UNIT

1000 KW 80% P.F. 1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to 1000 KW Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

THE NATIONAL POWER M

ER EQUIPMENT

ROTARY CONVERTERS

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers

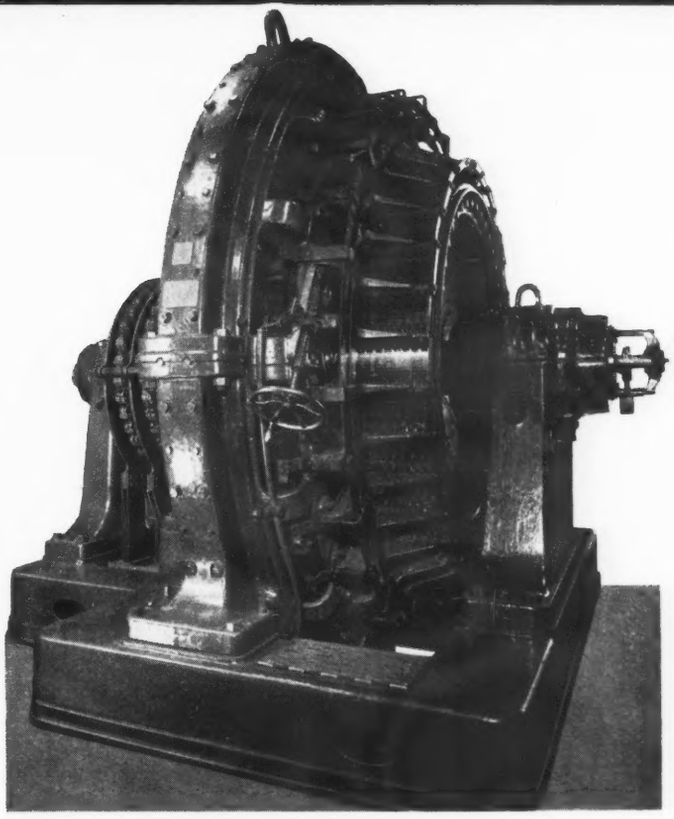
750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers

500 KW (2) WESTINGHOUSE, 600 volts D.C. 1200 RPM with 3 phase 60 cycle 6600-445/222 volt transformers

ROTARY CONVERTER

25 Cycle

1500 KW WESTINGHOUSE, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformer



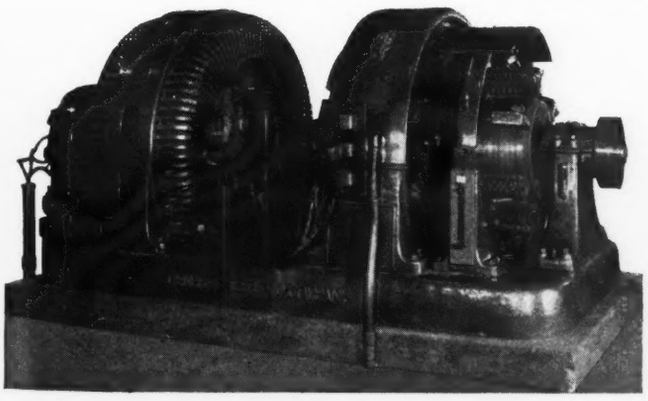
Actual Photograph

3500 KW WESTINGHOUSE ROTARY CONVERTER

3500 KW (2) Westinghouse booster type interpole rotary converters, 225-285 volts D.C. 225 RPM; 6 phase 60 cycle A.C. with 3 phase 60 cycle 13200 volt transformers. Complete with control.

MOTOR GENERATOR SETS

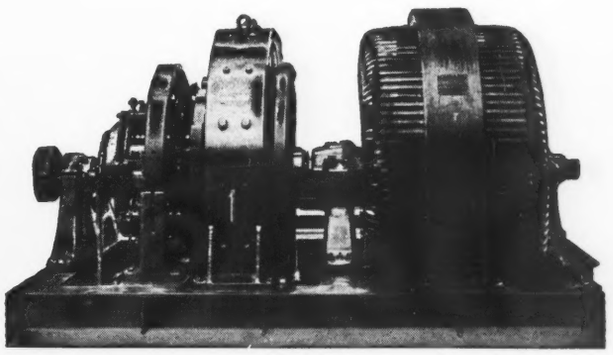
3 Phase 60 Cycle



Actual Photograph

750 KW GENERAL ELECTRIC MOTOR GENERATOR SET

750 KW GENERAL ELECTRIC direct current generator, 600 volts 720 RPM direct connected to 1100 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

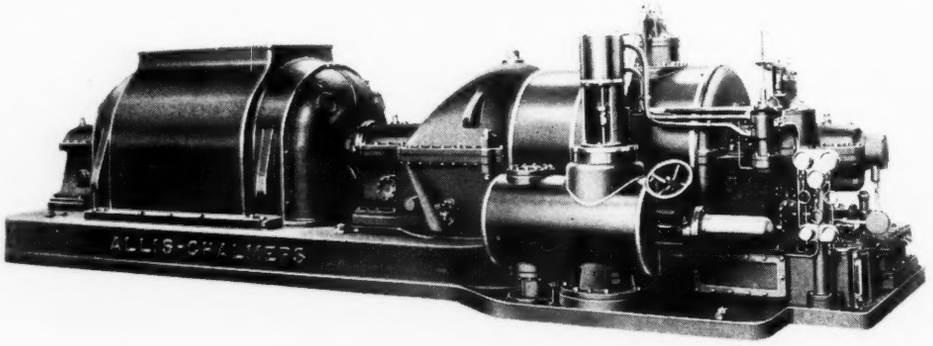
1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

R MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—Westinghouse 6250-KVA, 3/60/2300-v, 200# 500°F. TT. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 2500-KVA, 3/60/600-v, 200# 500° F. TT. Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1250 KVA, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

1—G.E., 625-KVA, 3/60/2300-v, 200# 500° TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Union Guardian Bldg. DETROIT, MICH.

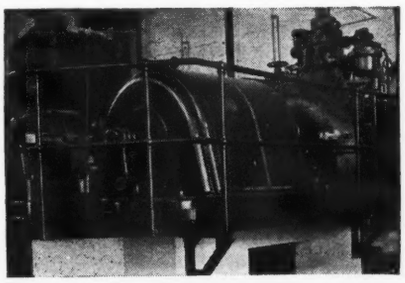
We Deal in Turbo-Generators Exclusively

"Convert . . . or else!" SAYS UNCLE SAM

Forced conversion of thousands of manufacturing plants to war production in 1942 is dead certain. Many readers of POWER will be directly affected, especially the plant engineer . . . When his factory "converts" to war work, as thousands will, the management will expect him to reach out into the thin air and gather all things needful to deliver enough air and steam and electricity and mechanical power to all the new productive machines in their new locations in buildings old and new.

from POWER

• Depend on "HEMPHILL" for the needed Power Equipment!



MOTOR GENERATOR SETS

1—500 KW, 650 volt, General Electric, syn.
1—50 KW, 250 volt, General Electric, sq. cg.
1—35 KW, 125 volt, El. Mach., sq. cg.
1—52½ KW 35 volt Westinghouse.
1—20 KW, 600 volt, G.E. sq. cg.
1—10 KW 125 volt Electric Machinery
1—16 KW 125/250 volt Westinghouse

D. C. GENERATORS

1—250 KW, 600 RPM, 250 volt, Sprague.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—75 KW, 675 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 450 RPM, 2200/4000 volt, G.E., slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., sl. rg.
1—350 HP, 300 RPM, 440 volt, G.E., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 H.P. 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 360 RPM, 440 volt, Westg. sq. cg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 H.P. 600 RPM, 4000 volt, G.E. Sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 H P. 1800 RPM, 440 volt, West. Sq. Cg.
1—150 HP, 900 RPM, 440 volt, Allis Chal. sl. rg.
1—150 H.P. 1200 RPM, 440 volt, G.E. Sq. Cg.
1—150 HP, 720 RPM, 440 volt, G E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
2—125 HP, 450 RPM, 440 volt, G.E., syn.
1—100 HP, 900 RPM, 220 volt, G.E., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.

MOTORS—3 PHASE 60 CYCLE—(Continued)

1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G. E., sq. cg.

MOTORS—D. C. 230 VOLTS

1—100 H.P. G. E. 575 RPM
1—100 H.P., 625 RPM, G.E.
1—65 HP, 1000 RPM, G. E., type RC.
1—50 HP, 1100 RPM, Crocker Wheeler.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
50 H.P. 750 RPM. G. E. CO1829
45 H.P. 1300 G. E. Type RC
1—40 HP, 1100 RPM, G.E., type RC.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—75 HP, 235/950 RPM, Burke.
1—60 HP, 600/1200 RPM, General Electric.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—20 HP, 750/1500 RPM, General Electric.
1—5 HP, 600/1200 RPM, General Electric.
6—5 HP, 400/1200 RPM, Westinghouse.
1—5 HP, 225/900 RPM, Electro Dynamic.

ALTERNATORS

1—625 KVA, 450 RPM, 600 volt, Westg.
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—375 KVA, 200 RPM, 240 volt, Elec. Mach.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—37½ KVA, 1200 RPM. 2400 volt, Westg.

TURBO-GENERATORS

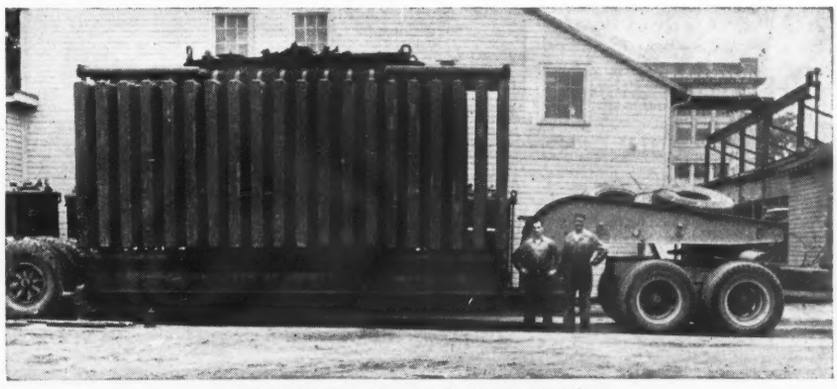
2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts
3—150 KVA, G.E., 33,000-2300/4000 Y.
3—150 KVA, Pittsburgh, 6600/440 volts.
4—150 KVA, G.E., 3 ph., 4150-120/208 v.
3—125 KVA, General Electric, 2300/480.
3—100 KVA, Westinghouse, 13200 250 volts.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
4—50 KVA, Westg., air cooled, 440-220/220-110 v.
3—50 KVA, Westinghouse, 220-110/220 volts.
3—50 KVA, G.E., 2200-110/220 volts.
52—37½ KVA, 2200-220/110 v.
10—25 KVA, Westg., air cooled, 440/220-110 v.
3—25 KVA, Moloney, 2200-220/110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
1—15 KVA, G.E., 440/110-220 volts.
4—10 KVA, G. E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

OIL CIRCUIT BREAKERS

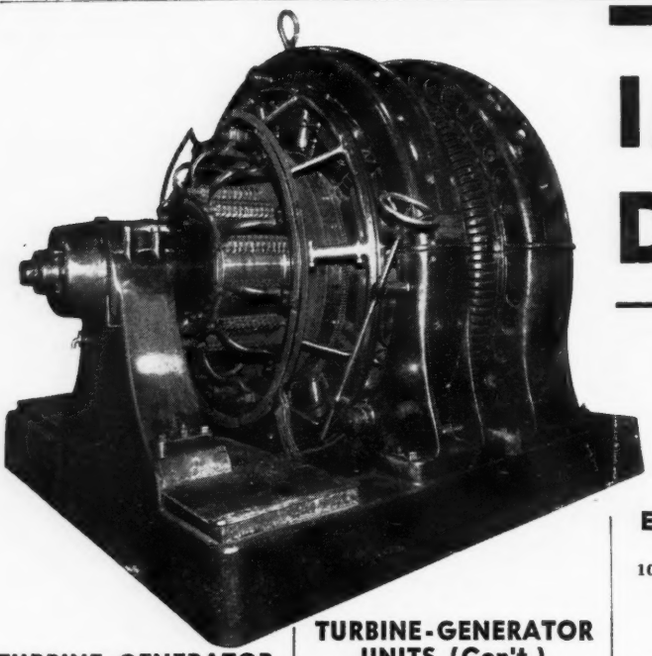
1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-34.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.



15,000 KVA Transformers for National Defense

J. L. HEMPHILL & CO., INC., Power Equipment

New York Phone: LOngacre 5-3227 — 1602 53rd ST., NORTH BERGEN, N. J. — New Jersey Phone: UNion 3-2600



IMMEDIATE DELIVERY!

ALLIS-CHALMERS MOTOR GENERATOR SET CONSISTING OF: 1500 KW, 600 Volts direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000 or 6600 volt, 300 RPM synchronous motor.

TURBINE-GENERATOR UNITS

3 phase 60 cycle

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

1875 KVA G.E. condensing 225 lb. pressure, 600° T.T. 2300 volts, 3600 RPM, complete with condenser.

1563 KVA G.E. condensing 175-200 lb. pressure 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA Westinghouse automatic extraction condensing, 150-200 lb. pressure, 10 lb. bleeder, 480 volts, 3600 RPM, complete with direct connected exciter and switchboard.

937 KVA ALLIS condensing 200 lb. pressure, 100° SH, 2300-550-480 volts, 3600 RPM complete surface condenser with auxiliaries, direct connected exciter—Modern and practically new.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

781 KVA Elliott automatic extraction condensing 200 lb. pressure, 100° superheat, 5 lb. bleeder, 2300 volts, 3600 RPM, complete exciter, switchboard, surface condenser and auxiliaries. Modern.

750 KVA G.E. condensing, 150-200 lb. pressure, 2300 volts, 3600 RPM, complete

TURBINE-GENERATOR UNITS (Con't.)

surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

250 KVA General Electric non-condensing, 150-200 lb. pressure, 10 lb. gauge back pressure, 240 volts, 3600 RPM, complete direct connected exciter and switchboard.

125 KVA General Electric non-condensing, 150 lb. pressure, 10 lb. gauge back pressure, 240 volts, 3600 RPM, complete direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1125 KVA G.E. 480 volts, 150 RPM direct connected 24" x46"x33" Erie-Ball cross compound engine, complete exciter, and rheostats.

1000 KVA G.E. 480 volts, 150 RPM direct connected 31" x36" Skinner Unaflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E., 240/480 volts, 150 RPM direct connected 26"x32" Skinner, Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

500 KVA G.E. 240 volts, 120 RPM direct connected 20" x42" Rice Sargent Corliss non-condensing engine, 125-150 lb., 10 lb. back pressure.

210 KVA Westinghouse, 480 volt, 257 RPM alternating current generator direct connected to Winton vertical Diesel oil engine.

ENGINE-GENERATOR UNITS (Con't.)

100 KVA WESTINGHOUSE, 240 volts, 277 RPM direct connected 14"x14" Ames Unaflow engine, 125-150 lb. pressure, 5 lb. back pressure.

ENGINE-GENERATOR UNITS

Direct Current

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

250 KW Westinghouse 1000 amperes, 250 volts, 200 RPM direct connected 23" x24" Ames Unaflow engine, 125-150 lb. pressure, complete switchboard and instrumentts.

150 KW G.E., 1200 amps., 125 volts, 225 RPM direct connected 19"x20" Ames Unaflow engine, 110 to 140 lb. pressure, complete with switchboard and instruments.

50 KW General Electric, 125 volts, 1200 RPM direct connected 75 HP Terry non-condensing turbine, 150 lb. pressure, 15 lb. back pressure, complete with switchboard.

MOTORS

3 phase, 60 cycles

875 HP, WESTGH. 440 V., 240 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

400 HP, WESTINGHOUSE type CW, 440 V., 500 RPM, slip ring.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

200 HP G.E. 2200 V., 580 RPM squirrel cage.

150 HP (2) G.E. 440 volts, 1800 RPM squirrel cage.

125 HP, (3) 80% P.F. Elec. Mchy. 410 V., 400 RPM synchronous with starting equipment.

125 HP, 80% P.F. Elec. Mchy. 440 V., 514 RPM synchronous.

50 HP, type 1, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

MOTORS (Con't.)

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

250 KW CROCKER-WHEELER 250 volt, 600 RPM compound wound interpole direct current generator.

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

900 KW G.E. 3 phase, 60 cycle, 480 volt, 150 RPM alternating current generator with exciter.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

300 KVA General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, three bearing belted generator complete with switchboard.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1500 sq. ft. WESTINGHOUSE surface condenser.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

SPECIAL

1 PRACTICALLY NEW WESTINGHOUSE FREQUENCY CHANGER SET CONSISTING OF: 655 HP, 3 phase, 25 cycle, 2200 volts, 300 RPM synchronous motor direct connected to 565 KVA 80% P.F., 3 phase, 60 cycle, 240 volt, alternating current generator complete and equipped with direct connected exciters, all panels with instruments.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

2500 KW 200/250# 600° T.T.60/3/2300 Surface Cond. No Switchboard

2500 KW 60/3/2300 Near New—All Auxiliaries
(G.E. may recommend slight alteration—8 mo. delivery)

WH	300KW	60/3/240–480V	120–200#			Jet Cond.
WH	500KW	60/3/480V	125–200#	100°S.H.	3600 RPM	Jet Cond.
GE	500KW	60/3/2300V	125/175#	100°S.H.	3600 RPM	Surf. Cond
WH	500KW	60/3/2300V	160#		3600 RPM	Jet Cond.
WH	500KW	60/3/2300V	150#			
WH	500KW	60/3/2300V	150#	100°S.H.	3600 RPM	Jet Cond.
GE	750KW	60/3/600V	150#		3600 RPM	Jet Cond.
WH	750KW	60/3/550V	150#	125°S.H.	3600 RPM	
GE	750KW	60/3/2300V	200#	100°S.H.	3600 RPM	Jet Cond.
GE	750KW	60/3/2300V	175–200#	100°S.H.	3600 RPM	Surf. Cond.
AC	**1000KW**	**60/3/440 V**	**175#**	**100°S.H.**	**1800 RPM**	**Surf. Cond.**
GE	**1250KW**	**60/3/2300V**	**200#**	**100°S.H.**	**3600 RPM**	**Jet Cond.**
AC	**1500KW**	**60/3/2300V**	**175#**	**100°S.H.**	**3600 RPM**	**Jet Cond.**
AC	**2000KW**	**60/3/440 V**				**Surf. Cond.**
GE	**2000KW**	**60/3/600 V**	**200#**	**100°S.H.**	**3600 RPM**	**Jet Cond.**
GE	**2000KW**	**60/3/2300V**	**150#**	**100°S.H.**	**1800 RPM**	**Surf. Cond.**
GE	**2000KW**	**60/3/2300V**			**1800 RPM**	**Jet Cond.**
GE	**8000KW**	**60/3/6600V**				

25 CYC. TURBO ALTERNATORS

GE	7500KW	25/3/2300V	175–200°	Surf. Cond.	Switchboard	Sep. Exctr.
WH	3500KW	25/3/12000V	200#	Surf. Cond.	Switchboard	Sep. Exctr.

and matching sets for Central Station installation.

BOILERS

FOR 200#					
5–520	HP EDGMR	Bx Hdr crs. drum	Stkrs	Compl	1922 Code
3–500	HP EDGMR	Bx Hdr long drum	Stkrs	Compl	1914
3–500	HP EDGMR	Bx Hdr			1914
15–500	HP EDGMR	Bx Hdr Chain Grates			
1–480	HP SPGFLD	Sect Hdr			1916
1–300	HP B&W	Sect Hdr Grates			1916
FOR 225#					
1–650	HP B&W	Sect Hdr	Stkr	Compl	1916
FOR 250#					
2–310	HP EDGMR	Bx Hdr	Stkrs	Compl	1926 Code
1–260	HP ERIE	Bent Tbs	Stkr	Compl	1917
FOR 160# to 180#					
1–280	HP HEINE				1926 Code
3–250	HP WICKES	Bent Tbe	Stkrs	Compl	1916
1–492	HP STIRLING		Stkrs	Compl	1920
2–500	HP ERIE CITY		Stkrs		1916
4–600	HP STIRLING		Stkrs		1910
3–500	HP STIRLING				1915
5–500	HP EDGMR	Bx Hdr	Stkrs	Compl	1912

SPECIAL PURPOSE
Flash type unit 250#

1–700	HP Pwr Spec. Co.,	Sect. Hdr.	Stkrs	Compl	1916

STEAM PLANT COMPLETE
1560 KVA 2300 V

GE TURBINES

1–500	KW	Surf.	Cond.
1–750	KW	Surf.	Cond.

WICKES BOILERS

3–250	HP	175#	100°S.H.

Coal Handling
Busses—Piping
Building Materials
Everything

DIRECT CURRENT MACHINES—STEAM & ELECTRICAL

RECTIFIERS 60 cyc.

500KW	600V	Complete	Boveri
900KW	600V	Complete	Boveri

MGs 60 cyc.

1–200KW	250V	DC		C–W
2–400KW	600V	DC	Swtchbds	GE
1–1500KW	450V	DC	Sep Exctr	GE
1–1500KW	600V	DC		GE

ROTARIES—60 cyc.

2–400KW	250V	DC	Compl	GE

OTHERS 25 and 60 cyc.

TURBO GENERATORS

200KW	600V	Geared Kerr	100#
500KW	600V	Geared Kerr	100#
500KW	600V	Geared Kerr	150#

FOR FIFTY YEARS, HEAVY POWER SPECIALISTS

Power Equipment for Prompt Shipment

M-G SETS 3 ph. 60 cy. (Syn.)

150 KW (2) Ridg. 275 v. DC—2200 v. AC 900 RPM
150 KW West. 550 v. DC—2200 AC 1200 RPM
125 KW Cr. Wh. 250 v. DC—440 v. AC 1200 RPM
125 KW G.E. 275 v. DC—2200 v. AC 1200 RPM
100 KW Ideal 275 V. DC—2200 V. AC 1200 RPM
90 KW Al. Chal. 230 v. DC 2200 v. AC 900 RPM
75 KW West. 275 v. DC—2200 V AC 900 RPM

STEAM UNITS

100 KW 250 v. DC West.—Skinner Engine
50 KW 125 v. Al. Ch.—Ball Engine.

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
700	G.E.	6600	1800
300	Al.Ch.	2200	600
300	Elec.Mchy	2200	72
190	Elec.Mchy	2200	90
75(2)	G.E.	2200	900
75	Westgh	220	1800

SLIP RING MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	2200	393	MT 432
300	G.E.	440	600	I-M
250	G.E.	2200	600	I-L
200	G.E.	2200	600	I-L
200	Cr.Wh.	2300	440	28
200	G.E.	2200	240	MT 412
150	G.E.	2200	600	I-L
125	G.E.	2200	600	I-L
125	Al.Ch.	2200	435	
100	Al.Ch.	220/440	575	
100	G.E. –25 cy.	220/440	500	MI-108
75	West.	220/440	575	CW868A
75	Ridgway	220/440	720	
50	West.	220/440	870	CW
50	Triumph	220/440	690	C13
50	West.	2200	500	CW868A
40	G.E.	220/440	600	MT552
40	G.E.	220/440	1200	MT332
37	Otis	220/440	1140	Int. Rated
30	G.E.	220/440	900	ITC5011

SQUIRREL CAGE MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	6600	1800	
450	West.	2200/220/440	50	CS
400 (5)	West.	2200/220/440	500	CS
350	West.	2200/220/440	500	CS
200	Al.Ch.	2200	600	
150	West.	220/440	580	CCL
125/40	Cr.Wh.	2200	700	125 AQ
125	West.	2200	1800	CS765A
125	Burke	220/440	1200	
125	Cr.Wh.	2200	700	125 AQ
100	Burke	220/440	900	
100	F. M.	220/440	600	BB
75	Lincoln	220/440	1800	
75	G.E.	2200	865	KT 352
50	G.E.	550	865	I-K
50	G.E.	220/440	720	I
50	West.	220/440	680	CCL
50	Triumph	220/440	690	B
50	Al.Ch.	220/440	690	
50	West.	220/440	560	MS
50	West.	220/440	575	CS 856
40	F. M.	220/440	1200	H12G
40	Al.Ch.	220/440	1200	
40	West.	220/440	870	CS
40	Al.Ch.	220/440	685	
40	Cr.Wh.	2200	350	
30	West.	220/440	1800	CS
30	Lincoln	220/440	1800	I-I
30	West.	220/440	1200	CS
30	Al.Ch.	220/440	1200	
30	G.E.	220/440	1200	KT 332
30	G.E.	220/440	900	KT 332
30	West.	550	900	CS

DC MOTORS (230 Volts)

HP	Make	Type	Speed
100	West.	SK 154 L	1800
100	West.	SK 142 L	1600
75	West.	S	700
60	West.	S	860
50	G.E.	RCP	1700
50	G.E.	CD115	850
40	West.	SK 110 L	1600
40	G.E.	CD 114	850
30	West.	S	1025
30	West.	SK	975
30	West.	SK	600
25	Reliance	185T	850
25	West.	SK	600
20	Natl B & E		1160
20 (5)	West.	SK 100 L	900
20	Reliance	131T	875
20	West.	SK 110 L	750
20	West.	S	975
15½	West.	S	965
15	Al.Ch.	E100	1750
15	West.	S	1325
15	West.		1160
15	West.	SK	675

DC VARIABLE SPEED MOTORS (230 Volts)

HP	Make	Type	Speed
100/125	G.E.	RC 39	600/720
100	West.	SK 154L	1400/1800
100 (2)	West.	SK 190	400/800
55	G.E.	DLC	425/850
40	West.	SK	600/1200
25	West.	SK 130	600/1200
20	West.	SK 100L	900/1800
10	West.	SK	600/1200
7½	West.	SK 70	650/1300
7½	West. 550 v.	SK 100	500/1500
6½	G.E. 110 v.	RC 26A	2500/3125
5	West.	SK 53	600/1800
5 (2)	West.	SK 63A	450/1800
5	West.	SK 63A	450/1000
5	West.	SK 93	400/800
4	West.	SA 4	400/1600
2½	West.	SK 33	500/1800
2	West.	SK 30	500/1800
2	G.E.	CR	500/1500

DC SERIES WOUND MOTORS

HP	Make	Type	Speed
3½	West.	K2	825
8 (2)	Northern		600
15	West.		650
25	Shaw		600
30	G.E.	CO2002	610
35 (2)	G.E.	CO2507	640
50	Shaw		600
75	G.E.	211 Int.	550
175	G.E.	MDS 190½	475

AC & DC GENERATORS

300 KVA Al. Ch. 2400/3/60 600 RPM with d.c. ext.
219 KVA G.E. 2400/3/60 200 RPM with exc.
200 KVA G.E. Type ATB 2400/3/60 720 RPM 3 brg.
110 KW Cr. Wh. DC 250 v. 720 RPM
75 KVA G.E. 2400/3/60 900 RPM with d.c. exc.
60 KW West. Type S DC 250 v. 900 RPM
55 KW G.E. Type CL, 115 v. 900 RPM
50 KW G.E. Type BR 125 v. 1800 RPM
50 KW West. Type S, 250 v. 1000 RPM
40 KW G.E. Type CD 250 v. 1000 RPM
30 KW G.E. Type CD 250 v. 1000 RPM
30 KW West Type S 250 v. 800 RPM
12½ KW West SK, 125 v. 375 RPM

AIR COMPRESSORS

2—505 cu. ft. 55# Sullivan 14 x 10 WG 6 Belted
500 cu. ft. 100# 2 stage Bury 19 & 12 x 12 Belted
2—355 cu. ft. 100# Chg. Pn. 12 x 10 GCB Belted.
125 cu. ft. Chg. Pn. 9 x 10 Belted.
164 cu. ft. 100# Chg. Pn. Steam Type GSS
125 cu. ft. 100# Bury 8 x 8 Belted.
65 cu. ft. 50# Penna. 7 x 5 Belted.
50 cu. ft. 100# Buhl 900 Gasoline Eng. Drive.
15 cu. ft. 100# Worthington Kerosene Eng. Drive.

OIL ENGINE DRIVE AIR COMPRESSOR

Chicago Pneumatic simplate valve type NSO3 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.

SHOP HOISTS

1—1 Ton Sprague 230 v. DC
1—2 Ton Yale & Towne AC 220/3/60
1—2 Ton Alfred Box AC 220/3/60
4—2 Ton Sprague 230/500 v. DC Monorail
1—4 Ton Sprague 230/500 v. DC Monorail.

HOISTS

75 HP Lidgerwood single friction drum, 24" dia. 24" face 4½" figs driven by HP West. CW slip ring motor.
75 HP Ottumwa sgl. fric. #3573 drum, 36" dia. 30" wide, 8" figs. gear driven by 75 HP West. CI S.R. 220/440 v. Motor.
50 HP 3 drum Mead Morrison geared to AC or DC Motor
50 HP 2 drum, both drums on same shaft, drums 30" dia. 24" face 5" figs geared to AC or DC motor.
30 HP Clyde sgl. fr. 16" dia. 19" face 5" figs. geared to 30 HP G.E. S.R. 220/440 v. Motor.
25 HP Orr & Sembower sgl. fric. 12½" dia. 16½" face, 6½" figs. driven by 25 HP Ideal S.R. Motor 220/440 v.

PUMPS

1050 GPM Gould 2 stage Cent. Bronze fitted, Iron case, 6" suc. 6" dia. 315' Head on base with 125 HP West CS 2300/3/60 1750 RPM.
700 GPM 277' Head 2 stage DeLaval 5 x 5 coupled to 75 HP West. Syn. Motor 230/440/3/60 1800 RPM 80% P.F. with dir. con. exciter.
260 GPM 277' Head 2 stage, 4 x 4 Manistee—coupled to 30 HP Westinghouse CS 220/440 v.
3000 GPM 90' Head Gould 10x12, dir. con. 100 HP West. SK 142 L. 230 v. 1600 RPM Motor.
2500 GPM 115' Head—LeCourtenay Pump. 8 x 8, dir. con. 100 HP West. SK 1400 RPM Motor, 230 v.
1000 GPM 95' Head Gould, 8" x 6", dir. con. 40 HP West. SK 110 L 230 v. 1600 RPM Motor.
800 GPM 95' Head Union Steam, Cent. Belted.
600 GPM 78' Head Union Steam—dir. con. 25 HP G.E. Kt 220/440 v. 3 ph. 60 cy. 1800 RPM.

BATTERY LOCOMOTIVES

4 Ton Type D Ironton 36" Ga. with 36 cells, 19 plate Exide Battery
5½ Ton Type D Ironton 36" Ga. with 48 cells, 21 plate Exide Battery.
Charging M.G. Sets & Panel for each loco.
5 Ton Jeffrey 42" Ga., 2 motor.

TRANSFORMERS

(1 ph. 60 cy.)

Qu.	KVA	Make	Pri. V.	Sec. V.
3	833	West.	22000	2200
3	500	West.	22000	2200
3	300	GE-furnace	25000/11000	110
3	250	Packard	22000	2200
1	220–3ph.	Al.Ch.	2300	115/230
1	150–3ph.	G.E.	2080/1980	230/460
3	150	G.E.	2200	110/220
3	100	Pgh.	6600/13200	220/440
2	100	West.	2200	220/110
1	75	West.	2200	220/440
3	50	G.E.	22000	2300
3	50	West.	2080	230/115
3	50	G.E.	2080	115/230
1	37½	G.E.	2300	115/230
3	37	West. (rot)	4400/4290	185/92½
1	30	G.E	1100/2200	122/244
20	25	G.E.	2200	122/244
3	25	West.	2080	230/115
10	15	G.E.	2200	122/244
1	15	Mahoney	2200	110 220
15	10	West.	2200	122/244
25	10	G.E.	2200	122/244
10	10	G.E.	2080	115/230
15	7½	West.	2200/1100	122/244
18	7½	G.E.	2200/1100	122/244
30	7½	G.E.	1100/2200	122/244
2	7½	Adams Bagnall	220	110/220
17	5	G.E	1100/2200	122/244
20	5	West.	2200/1100	244/122
15	5	G.E.	1100/2200	122/244
9	5	GE	1040/2080	115/230
5	2	G.E.	1040/2080	115/230
3	1	G.E.	4400/2200	244/122

In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.

MOORHEAD-REITMEYER CO., INC.

Pittsburgh, Pennsylvania

IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER

REBUILT POWER EQUIPMENT

Available Immediate Delivery

ROTARY CONVERTERS

150 kw., West. 250 v. rpm., 2200 3 ph. 60 cy.

1—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.

1—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

500 Amp. West. Arc Welding M.G. Set 75 v. 870 rpm. dir. con. to 220/550 v. 3 ph. 60 cy.

200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor. Complete.

150 kw. Westinghouse 275 v. 600 rpm., dir. con. 290 HP., 2200 v. 3 ph. 60 cy. Syn. Motor.

125 kw Crocker Wheeler 250 V. D.C. 1200 rpm., 220/440 v., 3 ph. 60 cy. induction

100 kw. G.E. 550 v. 900 rpm. dir. con. 2200/3/60 Syn. Motor.

50 kw., Westinghouse 250 v. type SK, 1200 rpm., dir. con. 118 HP., 220/440 v. 3 ph. 60 cy. Syn. Motor 70% P.F. complete

25 kw. G.E. 125 v. 1700 rpm. dir. con. to 2200/3/60 1700 rpm. motor.

30 kw. West. 60 v. 1750 rpm. dir. con. 46½ HP 220/3/60 1750 rpm. Ind. motor.

ENGINE GENERATOR SETS

50 kw. 250 V. D.C. International P.D.-80 DIESEL ENGINE.

200 kw. 480 v. 3 ph. 60 cy. direct connected, 300 H.P. Buckeye 4 cylinder vertical Diesel Engine.

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. velted to 110 HP 2 cyl. Bessemer Gas Engine.

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	Rpm.
1	1500	Allis Chal.	ANY	2200	485
1	700	G.E.	MT-432	2200	393
1	400	West.	CW	2200/550/220	435
1	400	West.	CW-967A	220/440	1170
1	300	G.E.	I-M	220/440	600
1	260	Burke	EMV-65	220/440	600
3	250	G.E.	I-M	550	600
3	250	G.E.	I-M	2200/220/440	600
3	200	G.E.	I-M	2200/220/440	600
1	200	G.E.	I-M	2200	514
1	200	West.	CW-956A	2200	690
1	150	G.E.	I-M	220/440	900
1	100	West.	CI	220/440	1750
1	75	West.	CI	220/440	860
1	60	Triumph	C-16	220/440	430
2	60	G.E.	MT-536	2200	1150
1	52	G.E.	ITC-5013	220/440	570
2	50	Allis Chal.	ANY	220/440	900
1	50	West.	HF-12A	220/440	900
1	50	West.	CW-461	220/440	900
1	50	G.E.		220/440	850
2	50	West.	HF	220/440	1120
1	50	West.	CW-636A	220/440	1150
2	40	G.E.	MT-332	220/440	1155
1	40	G.E.	MTC-5522	220/440	1125
1	40	G.E.	MT-342	220/440	860
1	40	Allis Chal.		220/440	685
1	40	G.E.	MT-552	220/440	575
1	25	West.	MW	220/440	680
1	25	West.	CI	220/440	870

SYNCHRONOUS MOTORS

4—150 HP. Allis Chal. 2200/3/60 1200 rpm. 70% P.F. 125 v. exciter dir. conn. thru coupling to 4—Falk Reduction Gears, ratio 1200—164 rpm. complete with control.

1—300 HP Elec. Machy. 2200/3/60 72 rpm. 100% P.F.

1—190 HP Elec. Machy. 2200/3/60 90 rpm.

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake. 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

SPEED REDUCERS

4—3 to 10 HP Thomas, Ratio 100 to 1; 15 to 1; 10 to 1; 5 to 1.

3—2 HP Crocker Wheeler 925 to 73 rpm.

3—7½ HP Crocker Wheeler ratio 50 to 1.

1—150 HP. R.D. Nuttal ratio 1.6:1.

4—150 HP. Falk Co. Reduction Gears, ratio 1200—164 rpm.

1—450 HP. Kerr Reduction Gear, 3800 to 720 rpm.

1—4½ to 7½ HP Link Belt Herringbone ratio 59.4 to 1.

1—30 HP Falk Ratio 15.7 to 1.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Prl.	Sec.	Make	Ph.
3	1500	22000	6600	Pgh.	
1	220	2300	115/230	All. Ch.	3 ph.
3	150	22000	6000	Pgh.	
1	150	2200	230/460	G.E.	3 ph.
1	100	2200	110/220	G.E.	3 ph.
1	100	2200	110/220	West.	
3	100	6600	550/440/220	Pgh.	
1	100	2200	220/110	West.	
2	75	2200	220	Burke	3 ph.
2	50	2300	220/440	G.E.	1 ph.
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G.E.	
1	50	2200	220	Burke	
3	50	2200	110/220	West.	
5	50	2200	110/220	G.E.	
1	37½	2300	220/440	Wagner	
3	37½	22000	2200	West.	
3	37	4400	185	West. (Rotary)	
1	30	2200	110/220	G.E.	
25	25	2200	110/220	G.E.	
1	25	550	110/220	G.E.	1 ph.
3	25	2200	110/220	Westg.	1 ph.
3	20	2200	110/220	G.E.	
1	20	1100/2200	110/220	Pgh.	1 ph.
10	15	2200	110/220	G.E.	
3	15	2300	220/440	Pgh.	
3	15	2300	220/440	Pgh.	1 ph.
35	10	2200	110/220	G.E.	
40	10	2200	110/220	West.	
100	7½	2200	010/220	G.E.	
50	7½	2200	110/220	West.	
75	5	2200	110/220	G.E.	
50	5	2200	110/220	West.	
7	5	550	110/220	Pgh.	1 ph.
2	5	6600	110/220	Pgh.	1 ph.

AIR COMPRESSORS

2—260 CFM Chic. Pneu. 12x10, 100± pres. 285 rpm. belt driven by 40 HP G.E. AC slipring Motors.

1—485 CFM Ingersoll Rand 14x10, 1 cyl. 60± pressure, belted.

SERIES MOTORS—230 v.

1—175 HP G.E. type MD-109¼ 475 rpm.
5— 75 HP G.E. type 211 550 rpm.
1— 68 HP G.E. CO-2007, 475 rpm.
1— 50 HP Shaw.
1— 50 HP West. K-10 (500 v.) 435 rpm.
1— 30 HP G.E. CO-2002, 610 rpm.
1— 15 HP Crocker Wheeler 270 rpm.

VARIABLE SPEED MOTORS—230 v. dc.

HP	Make	Rpm.	Type
100/125	G.E.	600/720	RC-39
100	West.	1400/1800	SK
100	West.	400/800	SK-180
40	West.	600/1200	SK
30	West.	850/1275	SK
25	West.	600/1200	SK
25	West.	825/1650	SK
20	West.	750/1125	SK
20	West.	575/1150	SK133
15	West.	675/1350	
10	G.E.	455/750	CD-95
10	West.	850/1275	SK
10	G.E.	625/1250	LC
9½/10	West.	565/1130	S
7½/10	G.E.	500/1500	RLC-114
7½	West.	850/1700	SK
7½	West.	475/950	SK
7½	West.	495/990	SK
7½	Cr. Wh.	385/1155	CM
7½	Allis Chal.	350/1050	—
7½	Cr. Wh.	385/1000	CM
7½	Cr. Wh.	385/1000	
7½	G.E.	500/750/1500	RLC
7½	West.	450/900	SK8OL
7½	West.	560/1680	SA
7½	West.	650/1300	SK
5	G.E.	400/800	RC-10
5	West.	400/800	SK
5	West.	450/1800	SK
5	West.	540/1080	SK-60
5	West.	450/1000	SK
5	West.	850/1700	SK
4	West.	500/1000	SK
3½	West.	850/1700	SK
3½	West.	400/1600	SA
3	West.	450/1350	SK
2½	West.	900/1800	SK
2½	Kimball	550/2200	—
2½	G.E.	500/1000	—
2½	West.	600/1200	SK
2½	West.	450/1800	SK
2½	Reliance	225/600	T
2½	West.	450/1800	SK
2½	West.	450/900	SK
2	West.	850/1700	SK
2	West.	1150/2300	SK
2	G.E.	700/2100	CD1-55
2	G.E.	500/1500	
2	G.E.	500/2000	FC-33
¼	Northern	700/2100	—

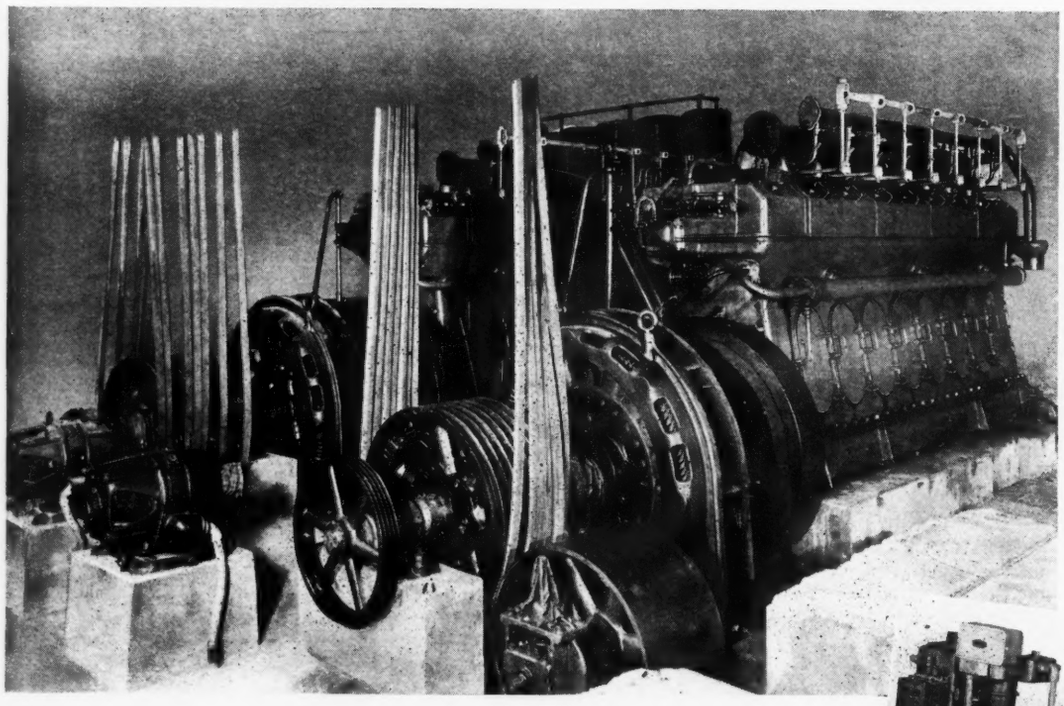
SQUIRREL CAGE MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
500	2200/440/220	West.	CS	720
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
400	2200/440/220	West.	CS	600
350	2200/440/220	West.	CS	450
300	2200/440/220	West.	CS	400
200	2200/440/220	West.	CS	250
200	220/440	West.	CS	580
200	2200	West.	CS	870
150	550/220/440	G.E.	—	575
150	220/440	G.E.	KT-562	690
150	2200/440/220	Al. Ch.	Syn.	1200
125	550/220/440	Al. Ch.	—	1750
100	2200/220/440	G.E.	I-K	600
100	220/440	Al. Ch.	—	1200
100	220/440	West.	—	1750
75	220/440	G.E.	I-K	570
75	220/440	West.	CS	580
60	220/440	Triumph	—	430
60	220/440	G.E.	KT	450
60	220/440	West.	CS	1150
50	220/440	Al. Ch.	—	690
50/100	220/440	West.	CS	545/700
50/32	220/440	G.E.	POS	800/640
50	550/440/220	G.E.	IK	900
50	220/440	G.E.	KT	1155
50	220/440	Reliance	—	1800

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS

DUQUESNE ELECTRIC & MFG. CO., Pittsburgh, Pa.

Two Heavy Duty
DIESEL DRIVEN GENERATORS
BRAND NEW — NEVER USED!



3/60-440
Can Drive
350 KWS

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Built By
RUSTON
HORNSBY
LTD.
of
LINCOLN
ENGLAND

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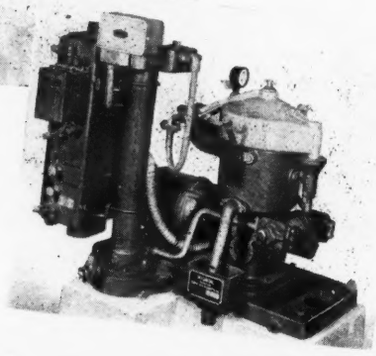


SPECIFICATIONS

Quantity

2—Ruston Vertical Diesel Engines, 440 H.P., 4 cycle, solid injection: 8 Cylinders 11x 14½—428 R.P.M.

2—Model 15-D Gould Hydroil Fuel Oil Purifiers, direct connected to half horse power polyphase induction motor.

2—Alternators Ideal Electric & Mfg. Co., U. S. A. 150 K.W., 400 R.P.M., 3/60—440 V. 40 degree, 80% power factor engine type synchronous alternators with field discharge rheostats, field discharge resistance, damper windings and split rotor.

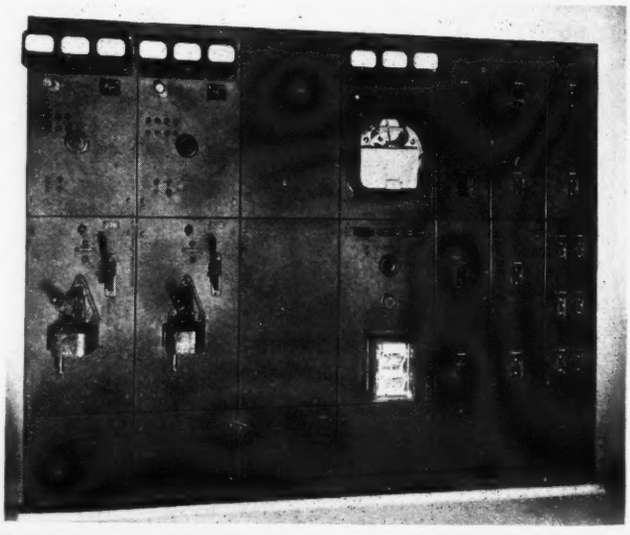
2—D.C. Belted Exciters mfgd. by Ideal Electric & Mfg. Co., U. S. A. 5 K.W., 1800 R.P.M. 125 volts, 40 degree shunt wound interpole types

1—Lexington Electric Switchboard, Seven Panels, 19 Nameplates, fused. Buss 800 amperes at current density of 800 amperes per sq. in. Instruments are Weston rectangular. Further information on request.

1—Struthers Wells Type F Oil Engine Exhaust Gas Cooler, containing 100—2" OD #10 BWG seamless steel tubes 12' length. Shell side working pressure 120# sq. in.

1—Struthers Wells Type NB-2 water to water exchanger, containing 16 1¼" steel tubes 10' length. Working pressure on shell side 50# sq. in. and 100# sq. in. on tube side.

Various belting, tanks, etc.



• PRICES ON APPLICATION •

ARNESSEN ELECTRIC COMPANY
116 BROAD STREET • NEW YORK, N. Y.

BOILER and POWER PLANT

Just Released for IMMEDIATE DELIVERY

GENERATING EQUIPMENT

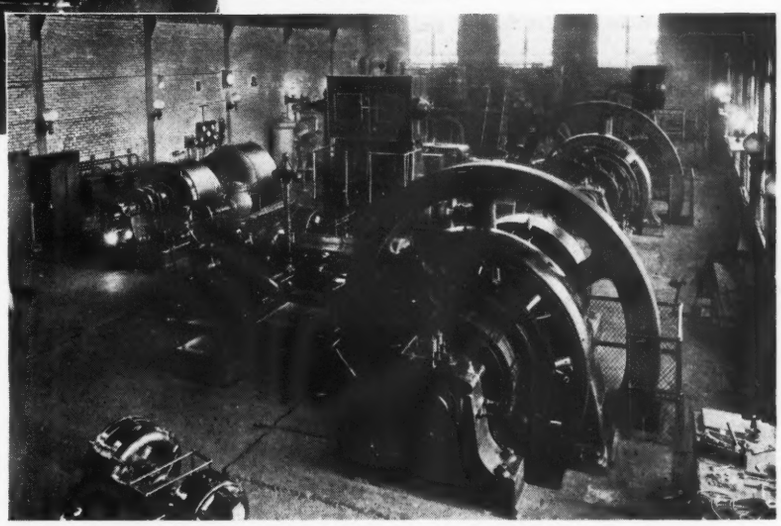
2—Ames Vertical Uniflow Engines, size 14" x 18", 4 cylinder, 150 lbs. pressure, 300 RPM, each direct connected to a Crocker Wheeler compound interpole Direct Current Generators, 240 volts, 2500 amperes, 300 RPM.

AC GENERATORS ARE AVAILABLE IF DESIRED

1—Ridgeway Turbo Generator Set, turbine mixed pressure, 135 lbs. high pressure and 16 lbs. low pressure, 0 superheat, 1800 RPM, direct connected to a Ridgeway 750 KW 230 volt Direct Current Generator, 3000 amperes complete with 3650 sq. ft. C. H. Wheeler surface condenser with circulating and air pumps.

1—16 ton 50 ft. span overhead travelling crane, hand operated.

Power Plant shut down just six weeks ago—all equipment in excellent operating condition—Write or wire for location and inspection details.



BOILERS and STOKERS

6—316 H.P. Heinie Water Tube Boilers, 180 lbs. pressure, ASME code complete with Jones 3 retort underfeed stokers, complete forced draft equipment, boiler feed pumps, coal crusher, Jeffrey coal elevator, Jeffrey spiral coal conveyor, etc.

PUMPS

1—2100 GPM 130 ft. Head 1800 RPM
1—2300 GPM 163 ft. Head 1800 RPM
1—1750 GPM 120 ft. Head 1800 RPM
2—2500 GPM 55 ft. Head 1800 RPM

TUBES

12,000 Condenser Tubes 1" OD 18 Gauge Admiralty 18 ft., long like new

STEAM ENGINES

100 KW SKINNER UNAFLOW 150#. 250 R.P.M. Direct Connected to 115 Volt WEST. Generator cpd. Interpole
80 H.P. CHANDLER & TAYLOR 13 x 16 —200 R.P.M. 100# pressure

WATER TANK

1—16,000 gal. Water Tower Tank, approx. 12' x 20' with 5" brass tail pipe, ladder, catwalk around tank, railing and 4 leg supports, complete.

GENERATORS

50 KVA West. 1200 R.P.M. A.C.
40 KW G.E. 1200 R.P.M. A.C.
45 KW Diehl Cpd. Int. 550 RPM 230 V. D.C.

TRANSFORMERS — MOTORS — TURBINES — GENERATORS — STEAM ENGINES — BOILERS

HEAT AND POWER COMPANY, INC.

670 SIXTH AVE. ***Chelsea 2-5415*** **NEW YORK CITY, N. Y.**

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

230 Volt—Constant Speed

	HP	Make	Type	Speed
1—	300	Cr. Wh.	CCM-108H	550
1—	250	Al. Ch.		525
2—	200	Whse.	SK	400
1—	200	G.E.	DMC	475
1—	150	G.E.	MPC	275
1—	140	G.E.	MDS-108	410
1—	125	G.E.	CDP-123	1750
3—	100	G.E.	LC-50	1200
1—	100	G.E.	RC-38	600

230 Volt—Adjustable Speed

1—	600	Whse.		150/275
1—	300	G.E.	MPC	250/400
1—	300	G.E.	MPC	275/550
2—	275	G.E.	DMC	500/750
1—	200	Whse.		400/500
1—	150	G.E.	MPC	250/450
3—	150	Whse.	SK-201	300/900
1—	100	Al. Ch.		950/1150
1—	75	Whse.	SK	475/900
1—	75	G.E.	CD-145	575/865
1—	75	Cr. Wh.	65-H	600/1200
1—	75	G.E.	C	500/1000
2—	60	El. Dy.	S	525/1050
2—	50	Cr. Wh.	CMC-81H	300/900
1—	45	G.E.	CD-125	450/1350
24—	30	Whse.	SA	500/1500

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
1—	1500	Whse.	3	OISC	26400/13200x460
3—	1000	G.E.	1	HKDD	13800x2300
3—	333	Pitts.	1	OISC	13800x440/220
3—	300	G.E.	1	H	13200x2300/575
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x250

SYN. CONDENSER

1—4000 Kva. G.E. 2 unit 3 Brg Condenser set with exciter consisting of Cond. 4000 Kva., 13200 volt, 3 ph. 60 cy. with 1150 HP, 13200 v. motor and 100 KW Exciter.

SYN. MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW G.E. 600 v. Gen. d.c. to 2100 HP 6600 v.
1—500 KW G.E. 600 v Gen. d.c. to 700 HP 13200 v.
1—250 KW. Cr. Wh. 250 v., Gen. dc to 350 Kva., 6000 v. motor.
1—250 KW G.E. 250 v. Gen. d.c. to 375 HP 220/440/2200 v. motor.
1—200 KW Whse. 250 v. Gen. dc to 290 HP 2200 v. motor.
2—150 KW, G.E., 550 V., Gen. d.c. to 225 H.P., 2200 V. syn. motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.
1—500 KW, G.E., 625 KVA, 2300 v., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 Cycle

2—1500 KW, Whse. 720 RPM 650 v. DC with 3-single phase, 53000 v. transformers and panel.
2—1000 KW whse. 900 RPM 650 v. DC with 3- single phase 11800 v. transformers and panels.
1—750 KW Whse. 720 RPM 250 v. DC with three phase 6600/2300 v. transformers and panels.
1—500 KW, Westinghouse, 900 RPM, 125/250 volt, DC, with 3- single phase, 60 cycle, 13200/6600/2300 volt transformers and panels.
1—300 KW, G.E., type HCC, 1200 RPM., D.C., 600 V. AC, 6 ph., 1200 RPM

ROTARY CONVERTERS

25 Cycle

3—1500 KW GE 225/275 v. DC Booster type each with 1600 KVA, 3 ph. 6765 volt transformers and panels.
1—500 KW GE 225/275 DC Booster type with 500 Kva 3 ph. 6765 volt transformer and panels.

A C MOTORS

3 phase—60 cycles

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	350	Cr. Wh.	301	2200	300
1—	300	G.E.	ATI	440	600
1—	300	G.E.	ATI	2300	600
1—	250	G.E.	ATI	220	450
1—	200	Whse.		440	514
3—	150	G.E.	TRB	220/440	450
1—	150	Whse.		2200/550	1800
1—	100	Whse.		2200/550	1800
1—	100	Whse.	HP	220	300
1—	100	Whse.	G	2300	900

Slip Ring

1—	600	G.E.	IM	2200	900
1—	600	Al. Ch.	ANY	2200	1180
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	Whse.	CW	440	585
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	435
2—	175	G.E.	IE-15A	2200	880
1—	150	G.E.	IM	2200	695

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	400	G.E.	KT	2300	580
1—	300	Whse.	CS	550	580
2—	300	G.E.	IK	2300	600
1—	300	Al. Ch.		2200	1160
1—	250	Al. Ch.		220/440	1150
1—	200	Whse.	CS	440	580
1—	200	Whse.	CS	550	720
1—	200	Al. Ch.		2200	1750
1—	150	G.E.	IK	2200/440	900
3—	150	Al. Ch.	AN	220/440	1750

RE-NU BILT BELYEA MOTORS

What are your requirements?
units up to 5000 kw
available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

AC TURBINE UNITS

6250 KVA G.E., 2300 V. cond.
4000 KVA Al. Chal. 2300 V. cond.
3125 KVA G.E. 2300 V. cond.
2500 KVA G.E. 2300 V.—Surface Condenser
1875 KVA Al. Chal. 2300 V. cond.
1250 KVA (2) G.E. 2300/4000 V., with surface Condensor.
937 KVA G.E. 2300/600 V., Non-Cond.
937 KVA G.E. 2300 V., 550° with Surface Condensor.
937 KVA Al. Chal.—Elliott, 480/240 V., cond. or mixed pressure; with Jet Condensor, etc.
780 KVA Al. Chal. 2300 V., with Surface Condensor, Rado-Air Ejectors, etc. NEW, never in service.
625 KVA Wghse, 2300 V., with Surface Condensor, etc.
625 KVA Al. Chal. 2 ph., 2400 V; Jet Condensor, etc.
625 KVA GE. 2300 V.; Bleeder; Condensor.
625 KVA Al. Chal.—Elliott, 240/480 V., Automatic Bleeder, with Jet or Surface Condensor.
625 KVA Wghse. 2400 V., with Jet Condensor, etc.
375 KVA G.E. 2300 V., non-cond.
375 KVA Al Chal. 2 ph., 2400 V., with Jet Condensor.
375 KVA G.E. 2300 V., Bleeder, with Jet Condensor.
312 KVA Ridgeway-Elliot 480/240 V., with Jet Condensor. Condensing or Mixed Pressure.
150 KVA Wghse. 240/480 V., Jet Condensor.
75 KVA Al. Chal. 240-440 V. non-cond.

AC ENGINE UNITS

375 KVA G.E. 22x27 Erie Ball 4 V.
312 KVA Elec. Mchy. 20x24 Chuse Uniflow
250 KVA G.E. 17x20 Erie Ball 4 V.
200 KVA Al. Chal. 14x36 Al. Chal. Corliss
150 KVA (2) G.E.—16x16 Skinner Uniflow.
125 KVA G.E. 14x15 Skinner Uniflow
112 KVA G.E. 14x18 Erie Ball 4 V.
100 KVA G.E. 14x16 Skinner Uniflow

BOILERS (ASME)

950 HP Sterling, 275#
728 HP E.C. Vert. 200#
685 HP Sterling 200#
650 HP Babcock & Wilcox 225#
500 HP (2) Heine bent tube 160#
500 HP Murray (Heine) 200#
484 HP Springfield Cross Drum 200#
471 HP Erie City Vert. 200#
451 HP Babcock & Wilcox, 160#
420 HP Sterling, 200#
320 HP Sterling, 200#
302 HP Babcock & Wilcox, 200#
295 HP (3) Sterling, 200#
270 HP (2) Erie City bent tube, low head. 180 lbs. with pulverizers. (A complete plant.)
253 HP (2) Heine, 160#—cross drum

BLEEDER TURBINE UNIT
625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condensor

GAS & DIESEL UNITS

1000 KVA G.E. 3 ph. 60 cy.; with Cooper Bessemer Nat. Gas. Engine
375 KVA Wghse. 3 ph. 60 cy.; Busch-Sulzer
200 KVA G.E. 3 ph. 60 cy.; Busch Sulzer Diesel.
168 KVA Ideal 3 ph. 60 cy.; Fulton 3 cyl. Diesel Engine; dir. con. exciter

OIL HEATING & PUMPING UNIT
Suitable for 1000 HP to 2500 HP in Boilers

TRANSFORMERS

5—1800 KVA G.E. 3 ph. 14,520-600 V.
1—1250 KVA G.E. 3 ph. 13,200/26400-2300 V.
3—833 KVA Wghse. 22000-2200 V.
2—687 KVA Maloney 13,800/460 V.
2—500 KVA Maloney 2200/220 V.
3—500 KVA Wghse. 22000-2200 V.
3—333 KVA G. E. 11,000/440 V.
3—300 KVA Maloney 17,500-440 V.
1—300 KVA Maloney 3 ph. 13,200/6600-220/440 V.
6—300 KVA Pittsburgh 22,000-2200/440 V.
2—250 KVA G.E. 6600/5940-2300 V.
3—250 KVA Packard 22,000-2200 V.
3—200 KVA Pitts. 25000-460 V.
4—200 KVA Wghse. 13,200-2300/4000 V.
3—200 KVA G.E. 22,000-2200/6600 V.
1—200 KVA G.E. 13,200-2300/4000 V.
5—200 KVA G.E. 13,200/26,400-2300 V.
5—200 KVA Wghse. 2200-110/220 V.
3—150 KVA Wghse. 11,000/440 V.
3—150 KVA G.E. 13,200-115/230 V.
1—150 KVA Wagner 13,860-110/220 V.
1—150 KVA G.E. 13,800-230/460 V.
3—100 KVA G.E. 13,200/2300 V.
3—100 KVA Al. Chal. 22,000/440 V.
3—100 KVA G.E. 13,200/6600/2300 V.
3—100 G.E. 13,200/460-2300/4000 V.
2—100 KVA G.E. 13,800-115/230 V.
1—100 KVA G.E. 33,000-2300/4000 V.
2—100 KVA G.E. 600-120/240 V.
2—100 KVA G.E. 6600/13,200/11,880-440-605 V.
1—100 KVA Wagner 13,860/220/110 V.
3—75 KVA Wghse. 11,000/440 V.
3—75 KVA G.E. 13,200-115/230 V.
4—50 KVA Wghse. 2200-220/440 V.
3—37½ KVA Wghse. 2300/575 V.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C
1— 375 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 375 KVA Erie City Slide Valve
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 250 KVA Erie City Slide Valve
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS

1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—200 KW Skinner Uniflow 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—400 KW West. (gas) 440 V.
1—93.5 KVA Anderson 2300 V.
1— 75 KVA Fair.-Morse 2300 V.
1— 40 KVA Fair.-Morse 2300 V.

WATER TUBE BOILERS

4—750 HP Edge Moor 200-lb.
6—400 HP Stirling 180-lb. Stokers
2—520 HP Heine 200-lb. Hand Fired
2—490 HP Stirling 200-lb.
2—407 HP Erie City 250-lb. Stokers
1—400 HP Stirling 200-lb.
1—400 HP B. & W. 160-lb. Stoker
2—360 HP Erie City 160-lb. Pulverized Coal
2—357 HP Casey-Hedges 175-lb. Stokers
2—350 HP Stirling 200-lb.
2—302 HP B. & W. 160-lb. Hand Fired
2—282 HP Edge Moor 200-lb. Stokers
2—270 HP Erie City 180-lb. Pulverized Coal
2—160 HP Stirling 155-lb. Hand Fired

SYNCHRONOUS MOTORS—60 Cy.

2—800 HP Electric Machy. 6600 V. 450 RPM
1—175 HP General Electric 440 V. 400 RPM
1—175 HP General Electric 230 V. 225 RPM
1—150 HP General Electric 440 V. 164 RPM
2—120 HP General Electric 440 V. 400 RPM
1—100 HP General Electric 4000 V. 900 RPM
1—100 HP General Electric 2300 V. 240 RPM

INDUCTION MOTORS—60 Cy.

2—400 HP G. E. slip ring 3800 V. 1800 RPM
2—300 HP G. E. sq. cage 440 V. 600 RPM
2—250 HP G. E. sq. cage 4000 V. 1200 RPM
1—250 HP G. E. slip ring 2200 V. 450 RPM
5—150 HP West. sq. cage 440 V. 900 RPM

AIR COMPRESSORS

1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sullivan Diesel
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1052 Ft. 100-lb. Ing. XRE. 60 cy. motor
2— 600 Ft. 100-lb. Ing. POC2, Diesel

OIL CIRCUIT BREAKERS

1— 800 A. 87 KV Am.Br. Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FK036 Outdoor
2— 600 A. 37 KV Conduit FO40A Outdoor
1— 400 A. 37 KV G. E. FKO-37 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
2— 600 A 15 KV Kelman CB-76 Outdoor
1— 400 A. 15 KV G. E. FK037 Outdoor

FREQUENCY CHANGERS

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G.E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 375 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA G. E. 25/60 cy. 300 RPM

ROTARY CONVERTERS—60 Cy.

1—1250 KW General Electric, 240 V.
2—1000 KW General Electric, 600 V.
2— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

SYNCHRONOUS CONDENSERS

1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

3— 600 KVA West. 120,000/2300 V.
1— 5000 KVA Allis 72000/6600 V. 3 ph.
3— 500 KVA West. 66000/2400
3— 500 KVA Allis 33000/480 V.
2— 1000 KVA G. E. 2300-11500/575 V.
3— 250 KVA G. E. 22000/11000 V.
3— 100 KVA G. E. 22000/6900 V.
3— 100 KVA Allis 22000/440 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
3— 150 KVA Pitts. 13800/230-460 V.
3— 75 KVA West. 13800/230-460 V.
3—1000 KVA Packard 11000/2300-4000 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
1— 3300 KVA G. E. 6600/110 V. 3 ph. Furnace
1— 1500 KVA West. 6600/106 V. 3 ph. Furnace
3— 1250 KVA G. E. 6600/550 V.
3— 100 KVA G. E. 6900/440-220 V.
3— 833 KVA Penn. 4800/120-240 V.
3—1000 KVA Pitts. 2300-4600/550 V.
4— 150 KVA G. E. 2300/115-230 V.
3— 100 KVA West. 2400/120-240 V.
6— 50 KVA G. E. 2400/240-120 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE—60 CYCLE 220/400 VOLT

H.P.	Make	RPM	Type	Frame
15	Allis-Chalm.	1750	2K54411	
20	Gen. Elec.	1750	KT	753
20	Gen. Elec.	600	I	K
25	Burke	900	EM	
40	Gen. Elec.	900	KT	336
40	Burke	1200	EM	45
40	Westing.	1750	CS	
50	Westing.	900	CS	
50	Gen. Elec.	900	KT	542
60	Burke	900	EM	7
60	Gen. Elec.	1200	I	K
60	Gen. Elec.	1800	I	K
75	Gen. Elec.	1200	KT	343
75	Gen. Elec.	1200	I	K
75	Gen. Elec.	1800	I	K
75	Gen. Elec.	900	I	K
100	Gen. Elec.	1750	I	K
100	Westing.	900	CS	
100	Lincoln	1200		
150	Gen. Elec.	1200	I	
150	Westing.	900	CS	
200	Gen. Elec.	600	I	K
200	Gen. Elec.	720	I	K
200	Gen. Elec.	900	I	K
200	Gen. Elec.	1200	I	K
250	Gen. Elec.	600	I	K
250	Gen. Elec.	720	I	K
250	Allis-Chalm.	900		
300	Gen. Elec.	720	I	K

Compressors in stock up to 300 H.P. Compensators.

WANTED
Write—Wire—or Phone
1—125 or 150 H.P. 230 Volt D.C. Motor, 200/1200 RPM, or any 6—1 ratio. Wire if you have this motor.

MOTOR GENERATOR SETS

1—150 KW Ridgeway, 250 Volt, D.C., 1200 RPM, Direct Connected to 3 PH., 2300 V, Synchronous Motor—Complete.
3—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP. Ridgeway synchronous motors. 3/2200/60/1200 complete with panels.
1—100 KW Crocker Wheeler 250 v DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM, complete.
1—75 KW Ridgeway 140 v DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.
1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. complete.

DIRECT CONNECTED PUMPS

1—280 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 3 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.
2—400 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.
3—350 G.P.M. Buffalo Pumps, Inc. 40 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	40	G.E.	25	2200/440
3	50	Whse.	25	2200/110/220
3	50	Whse.	25	11000/2200
3	100	Whse.	60	2200/220/440
3	100	Whse.	60	4600/230/460
3	100	G.E.	25	2200/220/440
3	100	G.E.	25	11000/2200
3	200	G.E.	60	2400/220/440
3	200	G.E.	60	4600/230/460
3	200	G.E.	60	6600/220/440
3	500	Pitts.	25	11500/100
3	1000	Pitts.	60	2300/4600/230/460

FREQUENCY CHANGERS

94 KVA Westinghouse Synchronous Set Generator, 62½ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.
1—120 KVA Gen. Elect. Induction Frequency changer, 440 volts 3 ph. 62½ cy. Driving motor 100 HP. 3 PH. 440 volt 25 cycle 720 RPM. Complete.
200 KW, Gen. Elec. 3 ph. 60 cy. 2300 v. direct connected to 200 HP Gen. Elec. Synchronous motor 3 ph. 25 cy. 440 v. complete with panels.

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM
500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.
300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.
225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.
1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

H.P.	Make	Type	Frame	RPM
300	Gen. Elec.	I	Form M	1185
75	Gen. Elec.	MT	537	1800
60	Gen. Elec.	MT	353	1800
60	Gen. Elec. (2)	MT	353	720
50	West.	CW	654C	1800
50	West.	CW	644C	900
50	West.	CW	654C	1800
40	Wagner	22WB		540
40	West.	CW	748	690
40	West.	CW	748	690
40	West.	CW	748	690
30	West.	HF	8B	1745
30	Gen. Elec.	MTC		1725
25	Gen. Elec.	MT	513	1800
25	Gen. Elec.	I	M	1200
25	West.	CW	750C	575
20	West.	CW	648A	575
20	West.	CW	644C	575
20	Gen. Elec.	MT	332	845
20	West.	CW	748A	575
20	West.	CW	748A	575
20	West.	CW	748A	575
15	Gen. Elec.	I-M		1725
15	Gen. Elec.	ITC		1725
10	Gen. Elec.	MT		1725

25 CYCLE, 3 PHASE, 440 VOLTS

H.P.	Make	Type	Serial	RPM
150	Gen. Elec.	MT563Y	5056230	725
125	Gen. Elec.	I-17	4550934	360
50	Gen. Elec.	MT547	8264084	720
50	Gen. Elec.	MT353	3879210	750
50	Allis-Chal.		7923K	715
52	Gen. Elec.	ITC5013	1773223	700
40	Gen. Elec.	MT543	4817983	750
40	Gen. Elec.	MT343	3887755	750

SPECIAL

1—20 HP, Gen. Elec. Motor 230 v. DC. Type CD83 1750 RPM.
1—75 HP, Westinghouse Motor Type SK. 230 v. DC 475/950 RPM variable speed.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
500	2300	Whse.	450
350	220–440	G.E.	1800
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–440	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
100	550–2200	G.E.	720
100	220–440	G.E.	720
100	220–440	G.E.	900
80	220–440	G.E.-MTC	900
75	440–220	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

600	220-440	G E.	720
500	2200	Whse.	900
400	440–220	Whse.	76
350	440–220	G.E.	200
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200
50	220–440	G.E.	1200

TRANSFORMERS—60 CYCLE

3—667 Kva. Whse. 22000-2300.
3—500 Kva, Whse. 22000-2300.
3—400 kva., G.E. type H, 13200-440.
3—250 kva., Al. Chal. 4150-480.
3—250 Kva, Whse. 13,800-460.
6—200 KVA G.E. 2500-230/460.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
2—150 kva., Whse. 4800/4156/2400-480/240.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E. type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 Kva, Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3—50 Kva, Whse. 22,000-2300.
3—37½ kva., G.E., type H-K 2200-460.
3—37½ kva., G.E., type H-K, 2300-230/115.
3— 25 kva., G.E., type H-K 2300-230/460.

A. C. GENERATORS

1—500 kva, 900 r.p.m. 2209 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300-V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
250	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	600
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

1—100 K.W., 250 V., 1200 R.P.M. Ridgeway, con. to 150 H.P., 2200 V., 3 ph., 60 cy., syn. motor.
1—60 K.W., 125 V., 1200 R.P.M. GE, type RC to 90 H.P., 4150/2300 V., 3 ph., 60 sy. syn.
1—25 K.W., 125 V., 1800 R.P.M., G.E., con. to KT 40 H.P., 2200/440 V., 3 ph., 60 cy. motor
1—300 KW 250/275 v., 1200 R.P.M. Connected to 450 hp. 4000/2200 v. 3 ph., 60 cy., Syn.

STEPHEN HALL & COMPANY, INC.
458 Seventh St., Hoboken, N.J.

IMMEDIATE SHIPMENT

STEAM TURBINES

2—375 K.V.A. G.E. 3/60/440 Non-Condensing 175 Lb. Steam 10 Lb. Back Pressure Geared Sets

2—938 K.V.A. G.E. Mixed Pressure 5 Lb. Low Pressure 150 Lb. High Pressure 1800 R.P.M. With Barometric Condensers. 3/60/2300

DIESELS

1—60 H.P. Fairbanks-Morse Style V.A. d/c to 3/60/440 Fairbanks-Morse Generator

1—80 H.P. Atlas Power Unit

1—160 H.P. Chicago-Pneumatic with Direct Connected Generator

SYNCHRONOUS MOTORS

1—60 H.P. Westinghouse 300 R.P.M. 440 volt 3 phase, 60 cycle, with starting Panel

3—175 H.P. Westinghouse 150 R.P.M. 3/60/2300

1—200 H.P. 327 R.P.M. 440 V. G.E. 3 phase, 60 cycle

BEESON BROS. SUPPLY CO.

1008 Alhambra Ave.

Los Angeles, Calif.

Direct Current Generators

1—40 KW C-W Type CCD. 250 v., 1100 RPM.
1—40 KW C-W Type CCD. 250 v., 1100 RPM.
1—35 KW GE Type RC 250 v., 900 RPM Generator.
1—5 KW GE Type CD 250 v. M G. Set.
1—45 KW GE Type ATB Form P.B. 550 v., 3 ph. Alternator.

MILTON WERBY & CO.
423 Atlantic Ave. Boston, Mass.

FOR SALE

We offer 523, 55-ton all-steel, self-clearing

DOUBLE HOPPER CARS

consisting of:

160 USRA construction: built 1921-1922; with A-B brakes: 1880 cubical feet capacity. 363 built 1910-1915; with KD-1012 brakes, 1683 feet capacity.

ALL HAVE FULL "U" CAST STEEL TRUCK FRAMES

Purchaser must buy all.

PRICE: $1700.00 each f.o.t. Pennsylvania.

TERMS: Cash with purchase.

DELIVERY CAN COMMENCE IMMEDIATELY AND BE COMPLETED IN ABOUT 60 DAYS—AND VERY POSSIBLY SOONER

Some $30,000 to $40,000 NEW REPAIR MATERIALS also available which you may wish to have inspected at the same time.

TIME and EXPEDITION ESSENTIAL and DESIRABLE.

Yours for Victory,

IRON & STEEL PRODUCTS, INC.

37 years' experience

13488 S. Brainard Ave. **Chicago, Illinois**

"ANYTHING containing IRON or STEEL"

RECONDITIONED ELECTRICAL EQUIPMENT

SYNCHRONOUS MOTORS

KVA	Make	Type	Volts	RPM	Ph.	Cy.
50	GE	ATB	220/440	1200	3	60
75	FW	VRN	220	1200	3	60
100	CW		240	900	3	60
130	GE	ATB-PB	220/440	600	3	60
150	GE	ATB-PB	2300	900	3	60
300	GE	ATB	600	600	3	60

DC 115 AND 230 VOLT

HP	Make	Type	Volts	RPM
100	GE	RC34 Comp	230	1700
125	GE	CO1832 Series	230	675
100	GE	CO1831 Series	230	675
75	GE	RC33 Comp	230	1700
50	GE	CO1810 Series	230	725
50	GE	CO1829 Series	230	750
50	WEST	K10 Series	230	475
30	GE	RC33 Comp	230	775
27	GE	HK107 Shunt	230	3600
30	WEST	SK90 Shunt	230	1700
20	CW	CMC Shunt	115	1700
20	WILSON	Shunt BB	115	1700
15	CW	CCM Shunt BB	115	850

SLIP-RING MOTORS

HP	Make	Type	Volts	RPM	Ph.	Cy.
250	AC		220	600	3	60
200	GE	1M	440	600	3	60
150	GE	1M	2200	720	3	60
150	GE	1M	440	600	3	60
75	GE	MT547	220	1200	3	60
75	GE	MT343	220	1700	3	60
75	GE	MT343	440	1200	3	60
60	IDEAL	AVA351	440	600	3	60
50	GE	MT552	440	600	3	60

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	RPM	Ph.
200	GE	1K	440	900	3
200	GE	1K	440	600	3
150	GE	1K	220	600	3
150	GE	1K	550	720	3
150	CW		2200	600	3
125	CW		2200	600	3
100	CW		2200	900	3
100	GE	1K	440	360	3
75	GE	KT543	550	1200	3
75	GE	1K	440	360	3

All Equipt Listed Available for Delivery on Short Notice. Write for Our List of Crane & Hoist Motors

Benjamin's for Motors, Inc.

49 BOND STREET, NEW YORK CITY • POSTAL TELEGRAPH: PBMI-N.Y.

IMMEDIATE DELIVERY
GUARANTEED REBUILT POWER EQUIPMENT

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
1000	Wtg.		440	900
875	Wtg.		400	240
800	Al. Ch.		2300	189
750	Wtg. (2)		4000/2300	1200
650	Al. Ch.		2300	1200
450	Wtg. (2)		4000/2300	1200
400	G.E.	TS	440/2300	360
225	G.E.	ATI	240	720
200	Wtg.	HR	2200	225
190	Elec. Mhy (2)		440	720
190	Elec. Mhy (2)		220	514

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	450
1500	Allis Chal.	ANY	2200	485
800	Wtg.	CW	6600	443
700	Allis Chal.		440	354
600	G.E. (2)	IM	2300	1770
500	G.E. (2)	IM	2200	600
350	G.E.	IM	2200	360
350	G.E.	MT	2300	300
300	G.E.	IM	440	300
350	Allis Chal.		2300	300
300	G.E.	MT	2200	514
200	Wtg.	CW	440	870
200	G.E. (2)	IL	440	600
225	G.E.	IM	440	600
200	Howell R. brg.		440	600
200	G.E.	IM	2200	600
200	Wtg.	CW	440	580
200	Wtg.	CW	440	345
150	Wagner	BR	440	1150
150	G.E.	MT	440	870
150	G.E.	IM	220	600
150	G.E.	IM	220	585
100	Wtg.	HF	440	230
300	G.E.	IM	440	293
130	G.E.	IM	440	700
75	Al. Chal.		2200	720
75	G.E.	MT	440	850
75	Allis Chal.	ARY	220	865

SQUIRREL CAGE

200	G.E.	IK	440	580
200	Wtg.	CS	440	580
200	Wtg.	CS	440	580
150	G.E.	IK	2200	1750
150	Wtg.	CS	2300	1175
150	Al. Ch.		440	1170
125	G.E.	IK	2200	580
100	Wtg. (2)	CS	440	1160
100	Wtg	CS	2200	1160
100	G.E	IK	220	1200
100	G.E.	IK	440	900
75	G.E.	IK	2200	1700
100	Wagner	38T3BM	2200	428
75	G.E. (5)	IK	220	600
60	Allis Chal.	AR	440	3500
60	Wagner	VRB	220	1200
60	G.E.	IK	220	900
60	G.E.	IK	220	900
60	Wtg.	CS	220	435
50	Howell	FBB	220	1725
50	Watson	KH	440	1720
50	G.E.	KT	2200	870
50	G.E.	IK	440	490

MOTOR-GENERATOR SETS

750 KW Elliott 220 v DC. 440 v syn.
500 KW GE 600 v DC 4400/2200 syn.
300 KW GE 3-unit 3-w 2200 v syn AC
225 KW Ideal 115 v DC 2200 v AC syn.
225 KW Wtg 115 v DC 2200 v AC syn.
175 KW AC 250 v DC 3/60/440 AC syn.
100 KW Wtg 125 v DC 220 v ind AC
100 KW AC, 125 v DC 440 v syn. AC
150 KW GE 250 v DC 2200/220 syn.
150 KW GE 600 v DC 4000/2300 syn.
150 KW GF 250 v DC 2200/440 syn.
150 KW Ideal 250 v DC 3/60/440 ind. AC
100 KW GE 125 v DC 440 v Ind AC
100 KW GE 230 v DC 440 v syn AC
100 KW GE 250 v DC 2200 v Ind. AC
90 KW GE 250 v DC 220 Ind AC
75 KW GE 125 v DC 220 syn AC
75 KW GE 125 v DC 220/440 Ind AC
75 KW GE 125 v DC 220 v AC Ind.
90 HP Wtg 110 v DC 2200 AC gen.
50 KW AC 125 v DC 2200 v Ind AC
50 KW GE 125 v DC 4000/2200 Ind AC
50 KW AC 125 v DC Ind. AC
33 KW Diehl 110 v DC 220 syn AC

FREQUENCY CHANGERS

500 KVA Westinghouse with 583 HP 3/25/2200/575/440/220 v. 750 RPM syn. motor 500 KVA 3/62½ cy. 2300/440/220 syn. gen. both machines amortisseur equipped, can be operated from 60 cy. to furnish 24 cy.

75—1½ HP Star ball bearing DC motors, 230 volts 1140 RPM, compound.

SPECIAL MOTOR

1—25/65 HP Wtg. oil well type 3/60/440 volts, 570/1160 RPM, style 88C138, with control, real bargain.

SYNCHRONOUS CONDENSERS
3 ph. 60 cy.

1000 HP Wtg. 3/60/440 volts 900 RPM
2000 HP GE ATI 3/60/11000 v. 600 RPM

ENGINES

500 KW GE MPC 250 volts DC generator, with Skinner uniflow engine.
500 HP Winton gas engine 8-cylinder overhead valve type, can furnish with AC generator.
125 hp. Waukesha gas engine, AC Gen.
165 hy. Hope gas engine, AC driven.
50 KW Waukesha gasoline engine—can be used for 550 volts DC or an AC generator furnished.

ROTARY CONVERTER

165 KW Gen. Elec. 125/250 volts DC 6 phase 60 cycle, 440 volts AC with switchgear and transformer equipment.
500 KW GE 240/275 volts DC 6 phase 60 cycle, 2200/4000Y AC, with switchgear and transformer equipment.

25 Cy. M.G's.

75 KW GE 125 v DC 3/25/440 AC 750 RPM interpole.
75 KW GE 125 V. DC 3/25/220 v 750 RPM 2-brg.

AC GENERATORS

KVA	Make	Type	Volts	Speed
187	G.E.	ATB	2300	600
175	Wtg.		2200	900
150	West Elec	S15C	230	900
125	Wtg.		2400	900
25	Cr. Wh.		240	1800
10	Cr. Wh.		240	1800
4	G.E. 1 ph 14 ½cy		110	860
1.2 KW	GE 1 ph 14 ½cy		110	860

TRANSFORMERS

2—5000 KVA 3/60/OISC 13800 pri 2300 v sec.
3—750 KVA GE 1/60/13890 pri 2200 v sec.
4—250 Wtg. 13800 to 2300/4000 v.
2—100 KVA GE 1/60 4600 to 120/240 v sec.
9—75 KVA Wtg. 1/60 3810 pri 240/122 sec.

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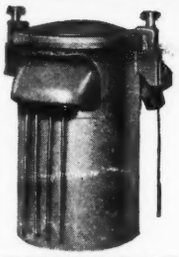
CHICAGO ELECTRIC CO.

1320 W. 22ND ST.
CHICAGO, ILLINOIS

-TRANSFORMERS-



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We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
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THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

SYNCHRONOUS CONVERTERS

500 KW West. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 6 0 D.C. 2300/4000 A.C. 1200 RPM
200 KW Al-Ch. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

SYNCH. MOTOR GENERATORS

200 KW G.E. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. 250 V. 2300 A.C. 720 RPM
200 KW G.E. 600 V. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 V. 2300 A.C. 900 RPM

IND. MOTOR GENERATORS

300 KW G.E. 250 V. 440 A.C. 720 RPM
200 KW G.E. 250 V. 440 A.C. 720 RPM

Each unit listed above is owned by us and is Available now for immediate purchase.

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Incorporated
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Babcock & Wilcox boilers

Two single set 500 H.P. each, 200±
One single set 460 H.P., 200±
These boilers were designed for burning a low grade fuel having an exceptionally wide furnace.
Prompt delivery, excellent condition.

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IMMEDIATE DELIVERY

3—G.E. Type H, 200 KVA, 1 ph., 60 cy., 22000 pri. 2300/4000Y sec., transformers with taps and oil.
3—G.E. Type H, 37.5 KVA, 1 ph., 60 cycle, 23000 pri, 115/230 volt sec.
Several hundred 550 volt, 3 ph., 60 cycle AC motors.
We have large stock all kinds equipment.
Send us your inquiries.

JACKSON-BAYLEY ELECTRIC CO.
CANTON, OHIO

300 KW ROTARY CONVERTERS

1—300 KW Burke Rotary Converter, 250 volts D.C., rolled steel frame, 6 phase, 60 cycles with transformer and swbds.
1—300 KW Westinghouse Rotary Converter, 600 volts D.C. 6 ph. 60 cy., pedestal bearings, 1200 RPM.

TRANSFORMERS

1—750 KVA Uptegraff 3 ph., 6600-4000.
3—100 KVA Gen. Elec. 1 ph., 22000-6900.
3—100 KVA Gen. Elec. 1 ph., 6900/11950Y-230/460.
1—100 KVA Pittsburgh 1 ph., 2200-220/440.
2—100 KVA Gen. Elec. 1 ph., 2200-110/220.
3—75 KVA Pittsburgh 1 ph., 4000-230/440.
3—50 KVA Westhse. 1 ph., 2200 110/220.

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LET US KNOW YOUR REQUIREMENTS

60 KW MOTOR GENERATOR SET

1—60 KW Westinghouse Synch. Motor Gen. Set, Type SK Generator for 125 volts D.C. compound wound, 90 HP. Type G Synch. Motor for 3-60-220 volts, complete with semi-automatic control unit.

MILL AND CRANE MOTORS

CO-2011, MDS-109½, MC-90, CO-1812, MDS-108, CO-2007, CO-1810, 38-B.

230 V-D.C. MOTORS

1—150 HP., W.E. Co., Type SK, 1750 RPM.
1—75 HP., W.E. Co., Type SK, 575/1150 RPM.
2—25 HP., W.E. Co., Type SK, 825 RPM.
6—20 HP., G. E. Co., Type BC, 1150 RPM.
5—15 HP., G.E. Co., Type LC, 300/600 RPM.
3—13½, W.E. Co., Type SK, 730/1460.

20 KW MOTOR GENERATOR SETS

1—20 KW Gen. Electric Ind. Motor Generator Set, 250 volts D.C., 3-60-220/440 volts A.C.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

FOR DETAILS, WRITE **JOHN D. CRAWBUCK CO.** 714-15 EMPIRE BLDG. PITTSBURGH, PENNA.

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From Salt Lake City, Utah:

1—Battery of 2—250 HP, 150# pressure, B. & W. Sterling type Boilers, complete with brick settings, together with all accessories including 5' x 75' high stack, with 4 Webster burners, with automatic controls.

1—520 HP Hamilton Corliss Engine Generator Set, direct connected to G. E. 350 KW Generator, 3/60/480 volt, 150 RPM, with G. E. exciter and Westinghouse 3 panel switchboard. (Used with above.)

From Missouri:

2—Allis-Chalmers—Kerr Turbo Generators, 500 KW, 3/60/480 volt, equipped with Westinghouse Blanc Jet Condensers. Turbine operated condensing or non-condensing at back pressure of 10-15 lb. Complete with switchboard and exciter.

2—Heine Type 357 HP, 2 drum O'Brien Boilers, with Laclede Christie chain grate automatic stokers, with automatic coal weighing devices, individual draft equipment, feed water heater, built for 175 lb. pressure.

1—Westinghouse Electrolytic Generator, 2000 amps., 200/40 volt, 650 RPM, belt driven, 3 pedestal.

1—Allis-Chalmers Electrolytic Generator, 1250 amps., 40/120 volt, 475 RPM, belt driven.

1—Allis-Chalmers Electrolytic Generator, 833 amps., 40/120 volt, 650 RPM, belt driven.

2—Swaby Centrifugal Pumps, 6", 8".

1—Alberger Vacuum Pump, steam driven, 8" x 16" x 12".

1—Laidlaw Dunn Gorden two stage, steam driven Compressor, 100 lb. pressure, 1300 cfm.

1—N. Y. Continental Jewell Water Filtration Plant, capacity 500 gpm.

2—Connorsville and Root Type SH Pressure Blowers, 24" suction and discharge, 57 and 65 cf capacity.

1—1000 lb. DC Shepard Electric Hoist, 14' lift.

1—Howe 100 ton Railroad Track Scale.

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183 VARICK STREET NEW YORK

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1—3000 KW G.E. 600 V. Cond.
1—2500 KW. G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW. G.E. 240 V. Cond.
1— 500 KW. G.E. 2300 V. Mixed P.
1— 500 KW. G.E. 600 V. Cond.
1—175 H.P. G.E. Turbine—only.

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1—2700 Cu. Ft.—IR—2300 V. Syn. Motor.
1—3588 Cu. Ft.—IR—Steam Driven. Cond.
1—782 Cu. Ft.—IR—55#.
1—888 Cu. Ft.—IR—2 stage Steam.
1—599 Cu. Ft.—IR—2 stage Belted
2—549 Cu. Ft.—IR—Duplex 35# pressure.
1—146 Cu. Ft.—IR—3 stage Belted 2000#

G.E. CENTRIFUGAL COMPRESSOR

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

BOILERS

2—300 H.P. B&W 160#
1— 60 H.P. HRT—125#

WATER WHEEL GENERATORS

1—312 KVA. 2400 V. connected to Rodney Hunt wheel 17' Hd.
1—625 KVA. Morgan Smith 42' Hd.

BELTED GENERATOR

1—500 KW. G.E. 550 V. 225—RPM.

INDUCED DRAFT FAN

1—126,000 CFM to 210 HP Turbines.
1—165,000 CFM to 450 HP Turbine.

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14—Motors, 25 cycle, 440-550 volts.
H.P. ranging from 15 to 350.

Also transformers, engines and cranes

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COMPLETE POWER PLANTS

WHAT DO YOU REQUIRE?

SPECIALS

2000 KW Turbo-Generator, 60-3-480 V. Surface Condenser, Reconnect 600 V.—Rewind for Higher Voltages
5000 KW otherwise as above, except 2300/4000
3500 KW Turbo 60-3-2300 V. Jet Cond.
2500 " " " " Surface Cond.
1500 " " " " Jet Cond.
1250 " " " " Jet Cond.
1000 " " " " Surface Cond.
750 " " " " Surface Cond.
500 " " 60-3-480 V. Surface Cond.
Boilers 4—1000 HP, 4—600 HP., 2—500 HP., 4—560 HP.

Also Smaller Water Tube & Fire Tube Boilers

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ALL SIZES AND ALL TYPES

INDUSTRIAL POWER HEATING

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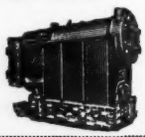

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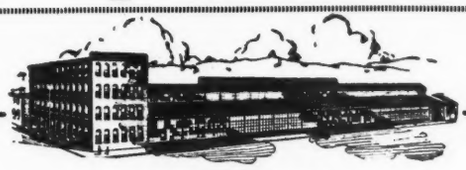

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HERE'S A PARTIAL LIST OF PRODUCTS WE HAVE AVAILABLE FOR *IMMEDIATE SHIPMENT—A COMPLETE, DETAILED* LIST MAY BE FOUND IN OUR CATALOG NO. 53 —*WRITE FOR IT!*

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2200 V., 3 Ph., 60 Cy.

1—60 HP, 600 RPM, General Electric, type MT-556
1—150 HP, 360 RPM, General Electric, type I-M
1—250 HP, 450 RPM, General Electric, type I-M
1—300 HP, 450 RPM, General Electric, type MT
1—300 HP, 600 RPM, General Electric, type I-M,
1—350 HP, 900 RPM, Westinghouse, type CW,

MOTOR GENERATOR SETS

3—500 KW General Electric, 600 volts, D.C., direct connected to 700 HP, 720 RPM, 2500/5000 volts, 3 phase, 60 cycles Synchronous Motor with direct connected exciters.
1—150 K.W. Westinghouse, 250 volt, D.C., connected to 225 HP, 2200 V, 3 phase, 60 cycle, 850 RPM, cage type motor.

GAS ENGINE GENERATOR SETS

1—Foos Gas Engine, 2 cyl. vertical, direct connected to Westinghouse 62.5 KVA, 60 cycle, 3 phase, 900 RPM, 2300 volts, with exciter.
1—Foos Gas or Gasoline, 6 cylinder Vertical Engine direct connected to Western Electric, 125KVA, 220 volt, 3 phase, 60 cycle, 720 RPM, with D.C. exciter.

STEAM ENGINE GENERATORS

1—125 KW, 125 volt, 250 RPM, Westinghouse Generator connected to a 15" x 16" Skinner Automatic Engine.
1—200 KW, 125 volt, 210 RPM, General Electric, Type MP connected to a 15 & 25" x 20" Tandem compound, right hand Skinner Engine.
2—300 KW Elliott, 250 volts, D.C., 165 RPM, connected to 21x28", 4 valve Automatic Type M Engines.

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CRANES

Electric Overhead traveling cranes

20 ton motors missing 50 ft span.
20 ton Bedford 50 ft span electric.
8 ton P.H. ac current 220 volts.
Also 1¼ and ¾ yard crawler cranes

All immediate delivery.

H. A. WOODWORTH ENG'R'G. CO. 705 OLIVE ST. ST. LOUIS, MO.

SPECIAL ITEMS IN STOCK

3—50 HP G.E. 3-60-2300 **compensators.**
100 HP G.E. 3-60-220-CR7122Y1 **automatic starting panel** for slip ring motor, less grids.
40 HP Westinghouse 230V DC enclosed armature **regulator.**

2—7½ HP New U.S. 3-60-220-100 rpm **gearhead motors.**
20 HP Westinghouse HF-3-60-220-585 **slip ring motor.**
50 HP Lincoln sl. Rg. 3-60-220-900 **Hoist** duty.
50 HP Westinghouse Sl. Rg. CI-3-60-550-900 **Hoist** duty.
60 HP Northwestern New shopworn double end **Sl. Ring.** 3-60-220-1200-40°.
100 HP G.E. I-K-3-60-440-720 rpm.
100 HP G.E. I-K-3-60-550-720 rpm.
100 HP G.E. I-K-3-60-2200-720 rpm.

1 HP G.E. B204, 230V DC 170 rpm **gearhead motor.**

3/5 HP G.E. CD73 115V DC 650/1950 **rpm motor.**
2—3 HP SK53, 230V DC 450/1800 **drip proof motors.**
40 HP SK103, 230V DC 1750 **rpm motor.**

6.3 HP 3-60-220-motor dir. connected to 4.5 KW 75V DC **generator,** 2 brg. West. 1740 rpm Set.

15 HP 3-60-550-motor dir. connected to 10 KW 250V DC **generator,** 2 brg. West. 1120 rpm **Set.**

25 HP SK83-230V DC motor dir. connected to 18.7 KVA 3-60-120 Volts 1800 rpm AC **generator,** Westinghouse 4 brg. almost new unit complete with panel and automatic AC voltage regulator, direct connected exciter.

Also complete stock of standard AC and DC motors and control, transformers, large DC air circuit breakers, generators, etc.

SANDMAN ELECTRIC MOTOR COMPANY
ELECTRICAL ENGINEERS
NEW ENGLAND'S LEADING DEALERS
49 PURCHASE STREET BOSTON, MASSACHUSETTS

Re-built Motors and Generators

1—400 HP, **Westinghouse,** type CW, 3 ph. 60 cy. 440 V, 450 RPM slip ring motor.
1—350 HP, **Allis-Chalmers,** 3 ph. 60 cy. 440 V, 600 RPM, slip ring motor.
1—350 HP **Burke,** 3 ph. 60 cy. 440 V, 600 RPM, slip ring motor.
1—300 HP **Allis-Chalmers,** 3 ph. 25 cy. 440 V, 485 RPM, slip ring motor
2—250 HP **Westinghouse,** type CS1012, 3 ph. 60 cy. 440 V, 600 RPM sq. cage
1—200 HP **Westinghouse,** syn. IPF 3 ph. 60 cy. 2200 V, 600 RPM, with direct connected exciter 3 or 2 bearing
2—150 HP **Allis-Chalmers,** 3 ph 60 cy. 440 V, 450 RPM, slip ring
1—200 HP **General Electric,** type 1, form K, 3 ph. 60 cy. 440 V, 450 RPM sq. cage
2—150 HP **Westinghouse,** type CW, frame 1000, 2 ph, 60 cy. 440 V, 450 RPM slip ring.
1—125 KW, **Bullock,** 3 ph, 60 cy, 2200 V, 900 RPM alternator.
2—75R, 2200 V, **Fairbanks-Morse,** 1800 RPM, 3 ph. 60 cy. slip ring motors direct connected to 500 GPM 3 stage 300 head pump
1—50 HP, **Ideal,** type SMS, 3 ph. 60 cy. 220 V, 1800 RPM, syn. DC exciter
1—40 HP **Fairbanks-Morse,** 3 ph. 60 cy. 2200 V, 3600 RPM, type HD. (new)
1—100 HP **Westinghouse,** type SK, frame 160, 230 V, 1100 RPM.
1—100 HP **General Electric,** type CD, frame 123, 230 V, 1200 RPM.
1—100 HP **General Electric** type RF 17 230 V, 400/1200 RPM
1—75 HP **Reliance,** 230 V, frame 985T 400 to 1200 RPM
3—75 HP, **Westinghouse,** type SK, frame. 160, 230 V, 1100 RPM
1—50 HP, **Westinghouse,** type SK, frame 160, 230 V, 565 RPM
1—50 HP **General Electric,** class 5. Form B, 600 V, 600 RPM
1—60 HP **Westinghouse,** type SK, frame 160, 230 V, 680 RPM
1—100 HP **Westinghouse,** type CCL, 3 ph. 60 cy. 220 V, 1750 RPM sq. cage
1—100 HP **Wagner,** type 26V5VBP, 3 ph. 60 cy. 440 V, 860 RPM sq. cage
1—100 HP **Allis-Chalmers,** type ANY, 3 ph. 60 cy. 220 V, 690 RPM slip ring
1—75 HP **Allis-Chalmers,** 3 ph. 60 cy. 440 V, 450 RPM, slip ring
1—75 HP **Westinghouse,** type CW, 3 ph. 60 cy. 440 V, 720 RPM slip ring 3 or 2 bearing.
1—75 HP **Fairbanks-Morse,** type H, frame 165C, 3 ph. 60 cy. 550 V, 900 RPM sq. cage
2—75 HP, **General Electric,** type I, 3 ph. 60 cy. 220 V, 720 RPM, sq. cage
1—75 HP **Lincoln,** type IQ. 2 ph. 60 cy. 440 V, 600 RPM, sq. cage
1—75 HP **General Electric,** type CD, frame 176-550 V, 250/1000 RPM (planer)
2—40 HP **C&C,** 230 V, 250/1000 (Planer)
1—30 HP **C&C,** 230 V, 250/1000 (Planer)
1—20 HP **C&C,** 230 V, 250/1000 (Planer)
1—10 HP, **C&C,** 230 V, 250/1000 (Planer)
1—7½ HP, **Reliance** 230 V, 250/1000 planer

The Wente Electric Co.

207 N. Fourth St. Hamilton, Ohio

Est. 1903

SEARCHLIGHT SECTION

6—600 HP Stirling boiler, with stokers, and all auxiliaries.
5—512 HP Stirling, Class S-26, 200#.
1—451 HP, 160# pressure, B.&W. sectional header.
6—600 HP B&W boilers, 200# pres. with stokers.
1—955 HP Stirling, 275# pressure.
1—2100 HP Badenhousen, 400 pounds pressure, with pulverizers.
3—300 HP Erie City bent tube boilers, with type E stokers 180# pressure.

1—600 HP Connelly, 200# pressure boiler.
1—200 HP Scotch Marine 150# pressure boiler.
1—2000 HP Cochrane metering feed water heater.
2—625 KVA General Electric turbines, surface cond.
1—3200 KW Allis Chalmers Condensing turbine with auxiliaries.
1—2500 KW G.E. turbine, 400 lb. pressure, complete.
1—2500 KW General Electric Condensing turbine with auxiliaries.
2—125 KVA Skinner (counterflow) Eng. Gen. sets.
2—300 GPM Turbine Driven Boiler Feed Pumps

2—312 KVA Skinner uniflow engine.
1—166 KVA Ames uniflow engine generator set.
2—168—KW Busch Sulzer full diesel engines.
1—865 KVA Fulton diesel generator set, complete.
1—450 KVA Chuse Corliss engine generator set.
1—2500 KVA Nordberg uniflow engine generator set.
5—180 HP Fairbanks-Morse Model 35, Oil Engines, new in 1935.
1—84" x 125' self-supporting steel stack.
1—3500 HP Swartwort open feedwater heater.

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800 HP, 625 KVA 3-60-2300 Volt Diesel.
75-100-150-180 HP Fairbanks Diesels.
260 HP 220 lb. ASME Watertube Boiler.
2—250 HP 180# Heine Watertube Boilers.
24 ton Link Belt Electric Loco. Crane.
360 HP Clutch & Pulley. Fairbanks Morse.
35 HP Clyde Gaso Hoist, 2 Drum & Swinger.
3 drum 8¼ x 10" American Steam Hoist.
250 KVA 3-60-2300 V. Chuse Eng. & Gen.

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With cir. pump and piping
30" Pipe Fittings
36000 GPM 27' Head Cent. Pump
100 TO 550 HP GASOLENE ENGS. Used—New
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900 NEW BOILER TUBES Stirling Badenhausen
2—4166 GPM. CENT. PUMPS 162' HD.
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60" VALVE F. & D.—A.C. MTR. DR.
PRAC. NEW VALVES AND SW.BD.

Ross Power Equip. Co.
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Gasoline-driven

Star Generator: 28 V, 400 amp. SB20-W
Engine: Buffalo, Type BA.
Complete with Panel.

1—AC GENERATOR SET

Gasoline-driven

Westinghouse Generator: 48 KVA, 3 phase, 120/240/480 V; 28 KVA. single phase, 120/240 V, 117 amp., 1800 rpm, 60 cyc., direct connected exciter.
Engine: Continental, 6 cylinder gasoline engine, complete with Switchboard with Circuit Breaker, Voltmeter, ammeter and Silverstat Regulator.

Electric Apparatus Repair Co.
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ENGINE GENERATOR SET

1—312 KVA West. 3/60/2300 v. belt, exct. dir. con. Murray Special Corliss left hand eng. 18x30.

AIR COMPRESSORS

1—610 c. ft. I.R. St. Dr. 100# air, 150# stm.

SURFACE CONDENSER

1—10 AD 4 pass 210 ft. Foster Wheeler over Comb. Air Circulating and Tail pump.

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1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond' 20-40x14⅝x36, with waterwork type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. Fine cond.

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Worth Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago, Ill.

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G. E. single phase, 60 cycles, oil cooled
3—500 KVA 13800 X 2400 X 600 V.
10—400 KVA 13800 X 2400 X 600 V.
All above in good operating condition

Paul Jay Electrical Machinery Corporation
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6—275 KW 250 volt Interpole Modern G.E. 230/250 RPM Generators for direct connection, with Rheostats—(These can be adapted as Motors).
5—40 KW 125 volt Interpole Modern G.E. 230/250 RPM Generators for direct connection with Rheostats—(These can be adapted as Motors).
3—1250 HP 500 volt DC Interpole 130 RPM Modern Motors or Generators.
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Steel Shafting 21'4" long, 22¼" diameter, with double set bearings and housing.

Miscellaneous lot New H.P. Air and Hydraulic Copper Tubing and Fittings, for 1500# pressure.

Bronze Propeller, built up, bronze blades, cast iron hub, 17'0" diameter, 15'6" pitch.

Propeller Wheel, 4 bladed, solid bronze, 17'6" diameter, 15'3" pitch.

2—Large, 16 cu. ft., and 2 small, 2½ cu. ft., Injection Air Bottles.

6—Maxim Silencers for 1200 H.P. Diesel engines.

1—Ingersoll-Rand Engine with G.E. Generators, solid injection, 2 cylinder, 4 cycle, 36 K.W., Diesel, 220 volts, D.C. (requires new cylinder heads.)

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NEW and USED!

All makes & sizes for prompt shipments

1—525 H.P. 200# Springfield Cross Drum Boiler.
4—500 H.P. Stirling 160#.
3—300 H.P. B. & W. 160#.
10—500 H. P. Edge Moor 200#.

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO

FOR SALE

100 K.W. Engine Generator Set

100 K.W. 2300 volt, 60 cycle, 3 phase alternator direct connected to 11" x 18" x 15" Tandem Compound Center Crank Skinner Engine, designed to operate on 150 lbs. steam pressure, non condensing. 7½ K.W. Exciter included.

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WESTINGHOUSE MOTOR

75 H.P., 700 R.P.M., 60 CYCLE, 3 PHASE, 220 VOLT, WITH RAILS

J. HUNGERFORD SMITH CO.
ROCHESTER, N. Y.

FOR SALE

1—180 H.P. Allis-Chalmers, Horiz. 2-Cylinder 16" x 24" Full Diesel Direct Connected to 156.5 Kva. 3/60/2300-Volt Generator.
1—280 H.P. De La Vergne, Horiz., 2-Cylinder 20" x 34 Full Diesel Solid Injection, Direct Connected to 240 Kva G-E Generator 3/60/2300 V. Both have Exciters, and Switch Boards
All Ready for shipment—Kansas City.
Write
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GENERATING UNIT

1—60 H.P. 300-RPM; Steam Generating Unit direct drive on 48-KVA Generator; Complete with all controls; $800 f.o.b. Plant.

PRODUCERS' CREAMERY OF OLNEY
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1—125,000 Gal. 1—50,000 Gal., 1—60,000 Gal. & Sprinkler System.
Steel & Wooden Tanks of all kinds
Are also in the market for Elevated Tanks—any size
1—150 HP F-M Diesel Eng.—Like New.

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Four, Size 18" Type TBS Carling Turbine Heavy Duty Stoker Type Blowers.

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COMPLETE POWER PLANT

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6—84"x19'6" H.R.T. Boilers, 3" Tubes
2—72"x18'8" H.R.T. Boilers, 3" Tubes
(The above hand-fired with shaking grates)
1—605 H.P. Union Iron Works 4-drum water tube, 200 lbs.
Elesco Superheater, Riley Pulverizer, Detrick Walls.

GENERATORS

1—500 K.W. Generator, single cylinder engine
1—1000 K.W. Generator, twin cylinder engine
1—1500 K.W. Generator, Cross Compound non conds. Engine
(each with panel boards and instruments)

SUBSTATIONS

7—Rotary Converter Substations complete
2—500 K.W. 5—300 K.W.

MOTOR

1—200 H.P. Synchronous Motor, 500 R.P.M. with starter
All A.C. Electrical equipment, 25 cycle, 3 phase, 6600 Volts
All D.C. Electrical equipment, 250 volts

DUPLEX PUMP

1—10x6x10 Worthington Duplex Piston Pump
1—7x9x8 Sullivan Air Compressor and tank with air piping

PIPING, VALVES AND FITTINGS

1—25 K.W. Engine Generator Set, 250 Volts, D.C.
1—75 K.W. Westinghouse Turbo Generator, 250 Volts, D.C.

ALL THE ABOVE IN SERVICE UNTIL APRIL 1942

TURBO GENERATOR

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BOILER

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100 KW Ridgway 275 volt D.C. 2300 volt A.C.
100 KW West. Rotary 275 Volt D.C. 2300 Volt A.C.
50 KW Allis-Chalmers 250 V. D.C. 2200 V. A.C.

SYNCHRONOUS MOTORS
3 phase, 60 cycle

2—G.E. 700 HP 720 RPM 6600/4000/2300 Volt
Burke 300 HP 900 RPM 440/220 Volt
Ridgway 150 HP 1200 RPM 2300/440 Volt
C.W. 100 HP 900 RPM 440/220 Volt
Fairbanks-Morse 75 HP 720 RPM 220 Volt

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Allis-Chalm. 250 HP 600 RPM 440/220 Volt

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1—G.E. RF-17 50/100 HP 450/1200 RPM
1—Reliance 1400-T 100/125 HP 300/900 RPM
1—West. SK-180, 100 HP 600/950 RPM
1—West. SK-180 45/90 HP 475/950 RPM
1—Diehl 60 HP 500/1500 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
2—Crocker-Wheeler 125-H 50 HP 175/700 RPM
1—Allis-Chalm. 35/70 HP 450/1350 RPM
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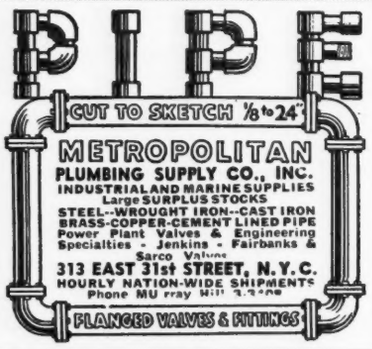
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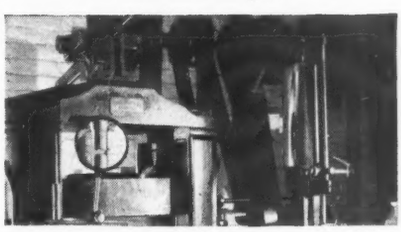

Physical tests

Metal control by photomicrographs

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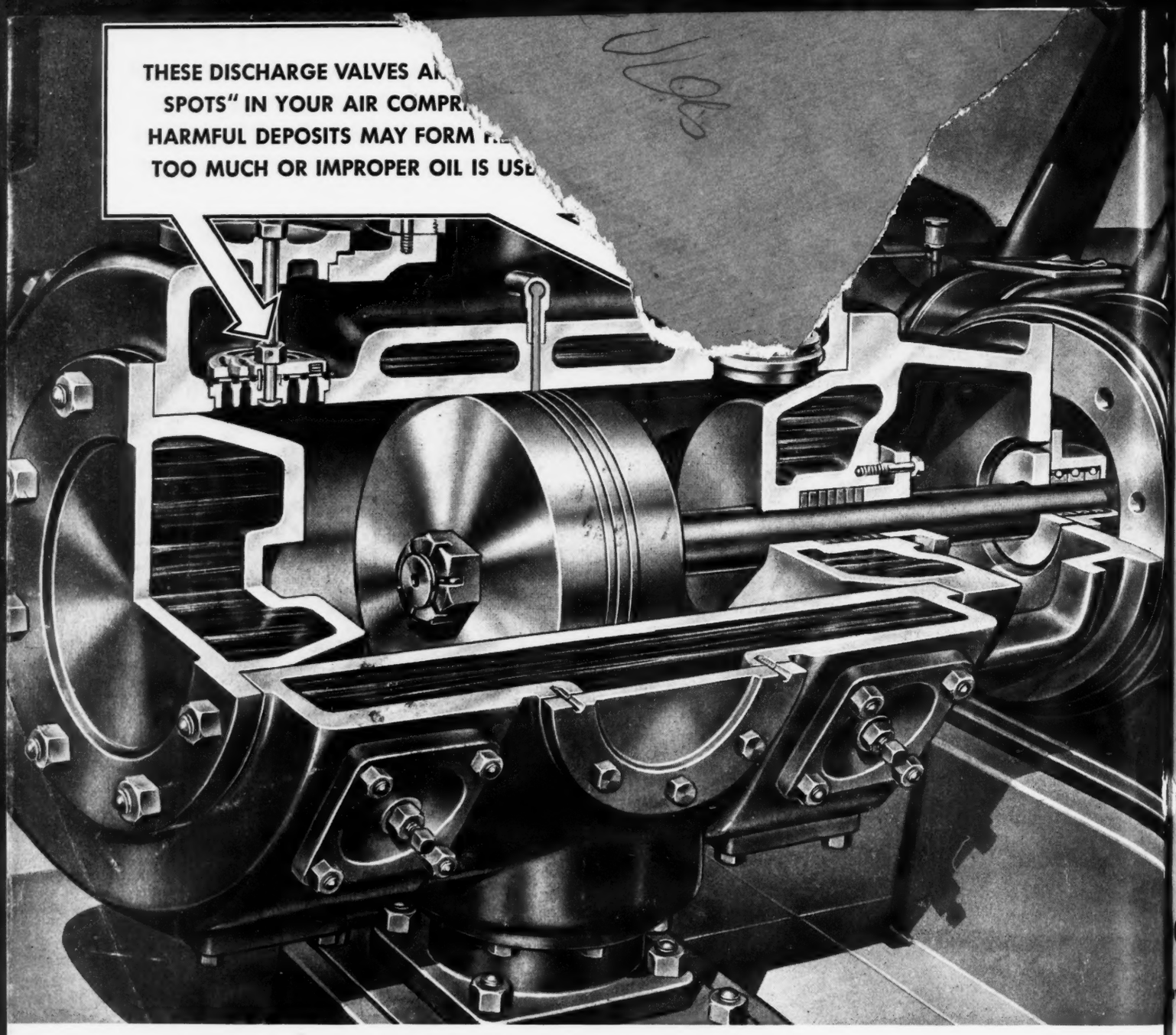

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